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Energy Research Abstracts

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Energy Research Abstracts

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Sample Citations

Report

18494 (DOE/ER/40438–T1) **[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report.** Haeberli, W. Phys. VI collaboration. Wisconsin Univ., Madison (USA). Dept. of Physics. [1989]. 12p. Sponsored by DOE Energy Research. DOE Contract FG02-88ER40438. Order Number DE89007246. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper briefly discusses the Wisconsin test facility for storage cells; results of target tests; the new UHV...

Report Analytic

18500 (INIS-SU—69, pp. 30-32) **Transition energies in Ne-like ions. Correlation effects.** Vainshtejn, L.A. AN SSSR, Moscow. Fizicheskij Inst. 1988. (In Russian). In *Experimental and theoretical physics. Collection.* Order Number DE89780060. Available from NTIS (US Sales Only), PC A03/MF A01; INIS.
Kratkie Soobshcheniya po Fizike.; no. 6.

SILVER IONS/energy-level transitions; XENON IONS/energy-level transitions; CORRELATIONS; D STATES; E STATES;...

54 (DOE/ER/60888-1-Vol.1, pp. 115-117) **Investigation of air pollution in house due to use of various fuels.** Luo, Dayu (Chengdu Sanitation (China)). Canada Mortgage and Housing Corp., Ottawa, ON (Canada). 1990. (CONF-900724-Vol.1: Indoor Air '90: 5th international conference on indoor air quality and climate, Toronto (Canada), 29 Jul - 3 aug 1990). In Indoor air '90: The fifth international conference on indoor air quality and climate. Volume 1: Final report. 786p. Order Number DE90017786. Source: NTIS.

Air pollution in houses caused by combustion of coal is more serious than that by combustion of natural gas and methane (primarily by SO_2 and NO_2). The gas concentration after cooking is higher than that before cooking, and it is higher in kitchen than in bedroom and outdoor. There were mutations in the extract from TSP in $30m^2$ air in the bedroom, kitchen and outdoor, where coal and natural gas were used. The supernatant saliva activity of children whose family uses coal is significantly lower than that of pumping streams.

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Report literature, usually identified by an alphanumeric identifier at the beginning of a citation, is available from the sources listed in the citation (see example of element 2 on page iii). Often the sources are listed as abbreviations. Corresponding addresses are provided at right from which documents with these abbreviations may be ordered. When "OSTI" is given, **DOE and DOE contractors may order these documents from OSTI.** (However, check with your library or information organization which may require that orders go through them to OSTI.) OSTI prices are based on total pages unless special pricing applies. The public should order from NTIS or from one of the other agencies listed in the citation. NTIS price codes may continue to appear in some records. To expedite processing, an order form is provided in the back of this publication. NOTE: The order numbers provide quicker access for report ordering. Use the order number where possible.

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Personal Author Index
Each author's name listed on a document cited in this issue is indexed. An index entry provides title and citation number; for secondary and other names, a cross-reference is given to the primary author name where the full index entry is located.

Subject Index
This index lists the main subject descriptors assigned to each record by indexing professionals. A secondary or qualifier term is used where necessary to describe materials, objects, and processes. Document titles may be enhanced with additional informative phrases where necessary. An excerpt from this index appears at right.

Contract Number Index
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Report Number Index
Technical report literature is indexed by the alphanumerical identifier of the report. Patent documents and conferences are included for convenience. Each entry lists the citation number, the source of availability of the document, an indicator of presence at a GPO depository library, order number, and distribution category. A typical entry is:

DOE/ER/40438–
T1 15:18494 NTIS, OSTI E 1.99: DE89007246 MF-411

Wisconsin Univ., Madison (USA). Dept. of Physics
[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 15:18494 (R;US)
Wisconsin Univ., Madison (USA). Lab. of Genetics
Organization of the R chromosome region in maize: Final progress report, June 1, 1983–May 31, 1986, 15:18255 (R;US)

Hadley, D.L., *See* Lee, A.D., 15:17651
Haeberli, W., [Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 15:18494 (R;US)

HYDROGEN ISOTOPES
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TRITIUM
Neutron-Rich Isotopes
Study on the strong neutron-rich nuclei of lightest elements, 15:18686 (RA;SU;In Russian)

FG02-88ER40438 **Wisconsin Univ., Madison (USA). Dept. of Physics**
15:18494 DOE/ER/40438–T1
FG02-88ER60664 **Rogers and Associates Engineering Corp., Salt Lake City, UT (USA)**

Subject Contents

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0103 Preparation

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32134 (ANL/CHM/CP–75097) **Drying of Beulah-Zap lignite, pretreatment with solvents and rehydration.** Vorres, K.S. Argonne National Lab., IL (United States). [1992]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920444–39: 203. American Chemical Society (ACS) national meeting, San Francisco, CA (United States), 5-10 Apr 1992). Order Number DE93017451. Source: OSTI; NTIS; GPO Dep.

Lignite (-100 mesh from the Argonne Premium Coal Sample Program) was dried in nitrogen under various conditions in a Cahn 121 thermobalance as part of a program on drying low rank coals for liquefaction. Samples were pretreated with solvents to determine the solvent's ability to displace water from the pores. Toluene had little effect. Acetone and methanol, selected because of water miscibility, were examined also. The methanol accelerated the drying, apparently because it was able to diffuse into the pores. The effect of drying on reactivity was examined by determining the rate of rehydration. Hysteresis was also examined. Rehydration is slow, and incomplete within a 23 hour period. The ability of carbon dioxide to substitute for nitrogen was examined. The behavior was similar with slight advantages for using nitrogen.

32135 (CONF-920886–, pp. 1-21) **Impact of the Clean Air Act Amendments of 1990.** Baker, D. (Illinois Department of Energy and Natural Resources, Mt. Vernon (US)). Virginia Center for Coal and Minerals Processing, Blacksburg, VA (United States). [1992]. From High efficiency fine coal preparation conference; Mt. Vernon, IL (United States); 12-14 Aug 1992. In *Workshop on high-efficiency fine coal preparation: Proceedings.* 304p. Order Number DE93014987. Source: OSTI; NTIS.

The requirements of the Clean Air Act Amendments of 1990 are outlined. The impact of these Amendments on the electric utilities in Illinois are presented. These impacts are discussed in terms of the cumulative excess allowances, utility coal markets, number of mines and mine closures, and economic and social impacts. State actions to mitigate these impacts are briefly discussed.

32136 (CONF-920886–, pp. 22-43) **Overview of the National Coal Preparation Program.** Barnett, W.P. Virginia Center for Coal and Minerals Processing, Blacksburg, VA (United States). [1992]. From High efficiency fine coal preparation conference; Mt. Vernon, IL (United States); 12-14 Aug 1992. In *Workshop on high-efficiency fine coal preparation: Proceedings.* 304p. Order Number DE93014987. Source: OSTI; NTIS.

The mission of the National Coal Preparation R&D Program is to develop the scientific and engineering knowledge base which industry needs to produce economically competitive and environmentally acceptable clean coal products for introduction as market conditions warrant. Meeting the goals expressed in the Administration's National Energy Strategy, and in the Clean Air Act Amendments of 1990 warrant such products now more than ever. The Program has two objectives. The first is to assure the continued use of coal in traditional applications, i.e., large industrial and electric utility boilers, by dealing with the environmental concerns regarding local, regional and global impacts of coal use. The second is to open new markets for coal use. Such new markets include: large industrial and electric utility boilers that now use oil; moderate-size boilers/furnaces (new and existing) for commercial, industrial, and cogeneration applications; and new concepts such as coal-fired diesels and turbines for both transportation and stationary power generation. Opening these markets to coal involves addressing not only environmental performance, but also serious technical and economic constraints associated with new end-uses. Various advanced coal preparation technologies could produce the high-quality coal needed to penetrate these markets.

32137 (CONF-920886–, pp. 44-80) **A Status of Advanced Coal Cleaning as a Compliance Technology.** Barnett, W.P. Virginia Center for Coal and Minerals Processing, Blacksburg, VA (United States). [1992]. From High efficiency fine coal preparation conference; Mt. Vernon, IL (United States); 12-14 Aug 1992. In *Workshop on high-efficiency fine coal preparation: Proceedings.* 304p. Order Number DE93014987. Source: OSTI; NTIS.

In 1988, the US Department of Energy's Pittsburgh Energy Technology Center identified three coal cleaning options for achieving flexible environmental control strategies aimed at reducing energy-related SO_2 emissions. These are selective agglomeration, advanced froth flotation, and advanced cycloning. Each technology relies on maximum liberation of pyrite and other mineral matter through feed coal comminution to fine and ultrafine size. Research projects designed to expeditiously develop each of these technologies to the point of commercial viability were initiated. This paper presents the status of these projects and the application potential of each technology to coal beneficiation.

32138 (CONF-920886–, pp. 81-93) **Dispersants for improving sulfur rejection in flotation.** Ehrlinger, H.P. III; Lytle, J.M.; Kohlenberger, L.B.; Brewer, K.K.; Norris, D.; Christophersen, J. Virginia Center for Coal and Minerals Processing, Blacksburg, VA (United States). [1992]. From High efficiency fine coal preparation conference; Mt. Vernon, IL (United States); 12-14 Aug 1992. In *Workshop on high-efficiency fine coal preparation: Proceedings.* 304p. Order Number DE93014987. Source: OSTI; NTIS.

During 1989–1992 flotation tests have been conducted in the laboratory, and later in a commercially sized Deister column flotation cell at Kerr-McGee's Galatia operation. A sample splitter was installed in the flotation circuit feed whereby a representative sample of feed was introduced to the column at or near its design rate of 1 ton per hour. Reagents were added in a variety of combinations. The test in which dispersants were added along with the traditional reagents yielded a higher recovery of energy matter (Btu) along with lower recoveries of pyritic sulfur and ash forming minerals. The project in general is discussed along with examples of the improvements gained by using dispersants.

32139 (CONF-920886–, pp. 94-124) **New methods for enhancing sulfur rejection in flotation.** Yoon, R.H. (Virginia Polytechnic Institute & State Univ., Blacksburg (US)). Virginia Center for Coal and Minerals Processing, Blacksburg, VA (United States). [1992]. From High efficiency fine coal preparation conference; Mt. Vernon, IL (United States); 12-14 Aug 1992. In *Workshop on high-efficiency fine coal preparation: Proceedings.* 304p. Order Number DE93014987. Source: OSTI; NTIS.

New methods for increasing sulfur rejection in the flotation method of cleaning coal was presented in graphic form. Pyrite rejection problems are discussed under the following topics: hydraulic entrainment, bubble-particle attachment, e.g., locked particles and hydrophobic particles; and physical entrapment.

32140 (CONF-920886–, pp. 125-146) **Use of the multi-gravity separator (MGS) for improved sulfur rejection.** Luttrell, G.H. (Virginia Polytechnic Institute & State Univ., Blacksburg (US)). Virginia Center for Coal and Minerals Processing, Blacksburg, VA (United States). [1992]. From High efficiency fine coal preparation conference; Mt. Vernon, IL (United States); 12-14 Aug 1992. In *Workshop on high-efficiency fine coal preparation: Proceedings.* 304p. Order Number DE93014987. Source: OSTI; NTIS.

The use of the multi-gravity separator (MGS) for improved sulfur rejection is presented in graphic form. The MGS is a novel-film separator used for separating fine particles. The advantages and operating parameters of the MGS are presented. The performance of the MGS for separating coal fines is briefly outlined. It was found

that the MGS effectively reduces pyritic sulfur, is less efficient in reducing ash, and is useful for "polishing" flotation products.

32141 (CONF-920886–, pp. 147-160) **The history of column flotation.** Luttrell, G.H. (Virginia Polytechnic Institute & State Univ., Blacksburg (US)). Virginia Center for Coal and Minerals Processing, Blacksburg, VA (United States). [1992]. From High efficiency fine coal preparation conference; Mt. Vernon, IL (United States); 12-14 Aug 1992. In *Workshop on high-efficiency fine coal preparation: Proceedings.* 304p. Order Number DE93014987. Source: OSTI; NTIS.

Column flotation is discussed in outline form. The advantages of this separation method are: high grade possible, stable operation, low air consumption, low maintenance, low operating costs, and unlimited scale-up potential. Future developments are outlined. These include sparging systems, process controls, contacting systems, and hybrid configurations.

32142 (CONF-920886–, pp. 161-174) **Microcel™ column flotation.** Harrison, K.E. Virginia Center for Coal and Minerals Processing, Blacksburg, VA (United States). [1992]. From High efficiency fine coal preparation conference; Mt. Vernon, IL (United States); 12-14 Aug 1992. In *Workshop on high-efficiency fine coal preparation: Proceedings.* 304p. Order Number DE93014987. Source: OSTI; NTIS.

Over ten years of research and development by the Virginia Polytechnic Institute and State University have led to the present version of a column flotation device now known as Microcel™. As with all technology developed by universities in Virginia, ICF Kasier Engineers, Inc. negotiated a license from CIT for use of the technology in the coal and kaolin industries. ICF KE designed the commercial version of the device and is now marketing its use. The technology is similar to other column technologies, but differs in several important areas. This presentation discusses those differences and presents performance data, typical applications, current commercial installations and cost for Microcel™.

32143 (CONF-920886–, pp. 175-181) **Commercial scale column flotation circuit at Powell Mountain Coal Company.** Groppo, J.G. (Univ. of Kentucky (US)); Parekh, B.K.; Peters, W.J. Virginia Center for Coal and Minerals Processing, Blacksburg, VA (United States). [1992]. From High efficiency fine coal preparation conference; Mt. Vernon, IL (United States); 12-14 Aug 1992. In *Workshop on high-efficiency fine coal preparation: Proceedings.* 304p. Order Number DE93014987. Source: OSTI; NTIS.

Cooperative efforts between the University of Kentucky Center for Applied Energy Research Laboratory and Powell Mountain Coal Company have resulted in the design, fabrication, installation and operation of a column flotation circuit capable of recovering fine coal (−100 mesh) from clean coal classifying cyclone overflow. The circuit consists of four columns (8 ft diam X 22 ft high) each designed to process 900 gpm of dilute (1–2% solids) slurry. The froth product is combined with classifying cyclone underflow and dewatered with the existing screen bowl centrifuges. When combined with the total plant product, the additional clean coal produced with column flotation increases the total product moisture by 0.5% while increasing plant yield by 2.0%.

32144 (CONF-920886–, pp. 182-194) **Commercial column flotation of fine coal.** Christophersen, J.A. (Deister Concentrator Co., Inc., Fort Wayne, IN (US)). Virginia Center for Coal and Minerals Processing, Blacksburg, VA (United States). [1992]. From High efficiency fine coal preparation conference; Mt. Vernon, IL (United States); 12-14 Aug 1992. In *Workshop on high-efficiency fine coal preparation: Proceedings.* 304p. Order Number DE93014987. Source: OSTI; NTIS.

The Deister Concentrator Co., Inc. has been fully involved in Column Flotation since 1977, with over 200 units installed worldwide. The presentation focuses on two (2) recent commercial column installations involving the flotation of coal. Mass flow information is presented along with laboratory pilot column scale up data. Additional information is presented covering the Deister External Bubble Generator (with internal aeration distribution) and the Deister Rotating Froth Wash/Froth Push System.

32145 (CONF-920886–, pp. 195-211) **Some recent developments in fine coal dewatering.** Fonseca, A.G.; Meenan, G.F. Virginia Center for Coal and Minerals Processing, Blacksburg, VA (United States). [1992]. From High efficiency fine coal preparation conference; Mt. Vernon, IL (United States); 12-14 Aug 1992. In *Workshop on high-efficiency fine coal preparation: Proceedings.* 304p. Order Number DE93014987. Source: OSTI; NTIS.

The area of fine coal dewatering is receiving increased interest from: (1) the coal producer interested in recovering more of the coal that was mined, (2) the preparation plant operator looking for a cost-effective alternative to thermal drying that will meet coal product moisture specifications, and (3) the desire of the end user for a consistent quality product that handles, stores and transports well. To achieve these aims, a number of devices that employ gravity, vacuum, and pressure are being developed, tested and demonstrated. These dewatering devices include (1) high G centrifuges, (2) ceramic filters, and (3) hyperbaric, belt, tube, plate and frame, and high pressure presses. Principles of operation and results from the application of several of these devices to fine coal are discussed.

32146 (CONF-920886–, pp. 212-217) **On-line analysis of coal.** Kawatra, S.K. Virginia Center for Coal and Minerals Processing, Blacksburg, VA (United States). [1992]. From High efficiency fine coal preparation conference; Mt. Vernon, IL (United States); 12-14 Aug 1992. In *Workshop on high-efficiency fine coal preparation: Proceedings.* 304p. Order Number DE93014987. Source: OSTI; NTIS.

Outokumpu Electronics has designed a new on-line coal slurry ash analyzer, based on an instrument developed at Michigan Technological University. The primary goal was to build an accurate instrument at the lowest possible cost. The instrument determines ash content from measurements of x-ray backscatter, iron K_α fluorescence, and low-energy γ-ray absorption. It is capable of measuring the ash content with a standard error of 1.1% ash over an analysis range of 9–21% ash and 7–22% solids. The analyzer was tested on coals from United States, Poland, Great Britain and the USSR.

32147 (CONF-920886–, pp. 218-250) **The application of the SHC process for fine coal cleaning.** Honaker, R.Q. (Southern Illinois Univ., Carbondale (US)). Virginia Center for Coal and Minerals Processing, Blacksburg, VA (United States). [1992]. From High efficiency fine coal preparation conference; Mt. Vernon, IL (United States); 12-14 Aug 1992. In *Workshop on high-efficiency fine coal preparation: Proceedings.* 304p. Order Number DE93014987. Source: OSTI; NTIS.

Oil agglomeration has been extensively studied as a fine coal preparation process. From the initial investigations, it was found that oil concentrations between 30–40% by weight of the total feed was needed to provide efficient separation of the fine coal from its associated mineral components. Recent studies have reduced this amount to as low as 4–10%. However, even at these concentrations, the processing cost remains relatively high. In addition, the oil agglomeration process has a difficult time reducing the sulfur content of a coal due to the hydrophobic nature of the oil-coated coal pyrite surfaces. Recent fundamental studies conducted at Virginia Tech have resulted in a novel fine coal cleaning process which allows the selective coagulation of coal particles without the use of an oily agglomerant. This process is based on a strongly attractive hydrophobic interaction energy not considered in the classical DLVO theory which exists between interacting hydrophobic surfaces. Experiments have shown that this additional attractive interaction energy allows naturally hydrophobic coal particles having a ζ-potential as high as -42 mV to coagulate. Thus, by using simple pH control, it has been found possible to selectively coagulate coal particles while dispersing the associated mineral matter. The resulting clean coal aggregates have been successfully separated from the mineral components using screening and sedimentation techniques. This treatment technique is referred to as the Selective Hydrophobic Coagulation (SHC) process. The pH region corresponding to optimum separation efficiency for the SHC process has been found to be between 8 and 9. Below pH 8, selectivity is hindered by the homocoagulation and heterocoagulation

of the mineral particles. Above pH 9, the coal particles become dispersed due to a large repulsive electrostatic interaction energy.

32148 (CONF-920886–, pp. 251-275) **Simulation of high-efficiency coal cleaning.** Gallier, P.W. Virginia Center for Coal and Minerals Processing, Blacksburg, VA (United States). [1992]. From High efficiency fine coal preparation conference; Mt. Vernon, IL (United States); 12-14 Aug 1992. In *Workshop on high-efficiency fine coal preparation: Proceedings.* 304p. Order Number DE93014987. Source: OSTI; NTIS.

A Coal Cleaning Simulator (CCS) is being developed to model both conventional and advanced coal cleaning technologies. The effort is part of a major research initiative by the US department of Energy/Pittsburgh Energy Technology Center aimed at advancing three coal cleaning technologies – advanced liquid cycloning, selective agglomeration, and advanced froth flotation. The CCS is based upon the commercially available ASPEN PLUS process simulator. Both process and economic analyses, for designing or operating coal preparation plants, are facilitated by using the CCS.

32149 (CONF-920886–, pp. 276-294) **Heavy-medium cycloning for fine coal processing.** Killmeyer, R.P.; Maronde, C.P. Virginia Center for Coal and Minerals Processing, Blacksburg, VA (United States). [1992]. From High efficiency fine coal preparation conference; Mt. Vernon, IL (United States); 12-14 Aug 1992. In *Workshop on high-efficiency fine coal preparation: Proceedings.* 304p. Order Number DE93014987. Source: OSTI; NTIS.

The advantages of heavy-medium cycloning for fine coal processing are presented in outline form. The conclusions of this study are: the micronized-magnetite produced by air classification of a dry grinding circuit, dust collector product; sharp cyclone separations along with excellent pyrite reductions down to 400 mesh; high micronized-magnetite recoveries (99.8+%) and pyrites (93–95%) using HGMS; and continuous unit operation testing warranted.

32150 (DOE/PC/92521–T53) **Combustion and emissions characterization of pelletized coal fuels: [Quarterly] technical report, March 1–May 31, 1993.** Rajan, S. (Southern Illinois Univ., Carbondale, IL (United States). Dept. of Mechanical Engineering and Energy Processes). Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019803. Source: OSTI; NTIS; GPO Dep.

Pelletization of coal offers a means of utilizing coal fines which otherwise would be difficult to use. Other advantages of coal pelletization include: (a) utilization of low grade fuels such as preparation plant waste, (b) impregnation of pellets with calcium carbonate or calcium hydroxide sorbent for efficient sulfur removal, and (c) utilization of coal fines of low quality in combination with different types of binders. The objective of this project is to investigate the carbon conversion efficiency and SO_2 and NO_x emissions from combusting pelletized coal fuels made from preparation plant waste streams using both limestone and calcium hydroxide as sorbent and cornstarch and gasification tar as binders. The combustion performance of these pelletized fuels is compared with equivalent data from a reference run-of-mine coal. Six different samples of coal pellets have been secured from ISGS researchers. Combustion and emissions characterization of these pellets in the laboratory scale 4-inch diameter circulating fluidized bed have been performed on some of the pellet samples. The pellets burn readily, and provide good bed temperature control. Preliminary results show good carbon conversion efficiencies. Oxides of nitrogen emissions are quite low and sulfur dioxide emissions are as good as or lower than those from a representative run-of-mine coal.

32151 (DOE/PC/92521–T54) **Clean, premium-quality chars: Demineralized and carbon enriched: [Quarterly] technical report, March 1, 1993–May 31, 1993.** Smith, G.V. (Southern Illinois Univ., Carbondale, IL (United States)); Malhotra, V.M.; Wiltowski, T.; Myszka, E. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019804. Source: OSTI; NTIS; GPO Dep.

The overall objective of this two-year project is to evaluate methods of preparing demineralized and carbon enriched chars from Illinois Basin coals. There are two processing steps: physical cleaning of the coal and devolatilization under different environments to form chars. Two differents techniques were used, in-situ Diffuse Reflectance FTIR measurements and BTU measurements. Experiments were performed with coals IBC-101, 102, and 104 as received and after cleaning. DR-FTIR spectrums helped to explain the possible existing chemical bonds in the coal structure as well as their changes during drying and mild pyrolysis. Drying coal causes hydrogen bonds between water and coal to be broken. Liquids produced above 500°C are much higher in aromatic content, thus, effectively reducing the concentration of aliphatic groups in the overall liquid yield. BTU values of coals after methane treatment are higher than after helium treatment.

32152 (DOE/PC/92521–T61) **Carbonation as a binding mechanism for coal/calcium hydroxide pellets: [Quarterly] technical report, March 1, 1993–May 31, 1993.** Lytle, J. (Illinois State Geological Survey, Champaign, IL (United States)); Hackley, K.; Dagamac, M.; Berger, R.; Schanche, G. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019811. Source: OSTI; NTIS; GPO Dep.

This research is an investigation of calcium hydroxide, a sulfur-capturing sorbent, as a binder for coal fines. The reaction of carbon dioxide with calcium hydroxide, referred to as carbonation, is being studied as a method of improving pellet quality. Carbonation forms a cementitious matrix of calcium carbonate. The effect of particle size and compaction pressure on pellet strength was studied using a laboratory hydraulic press. Particle distributions with mean sizes of 200, 90 and 40 microns were tested. The results indicate that pellet strength increased with decreasing particle size and increasing compaction pressure when calcium hydroxide was used as a binder. Pellets containing 10 wt% calcium hydroxide increased in strength by approximately 40% when air dried for one day. This increase in strength is attributed to carbonation of the calcium hydroxide via atmospheric carbon dioxide. Corn starch, an adhesive binder, was tested at the finest particle size. Pellet strength did not increase as a function of increasing compaction pressure. At the finest particle size and highest compaction pressure (18,750 psi), dried pellets formed with 2 wt% corn starch were equivalent in strength to pellets containing 5 wt% calcium hydroxide.

32153 (DOE/PC/92521–T62) **Development of an on-line image analysis for assessment of pyrite liberation: [Quarterly] technical report, March 1–May 31, 1993.** Max Yen, S.C. (Southern Illinois Univ., Carbondale, IL (United States)); Chu, P.T.C. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019812. Source: OSTI; NTIS; GPO Dep.

The degree of pyrite liberation is a key to determine whether a batch of ground coal obtained through a grinding process is acceptable. Currently, the liberation analysis is conducted manually through a microscope with a commercial image analysis software. This procedure is very labor intensive and time consuming. As a result, an automation procedure based on the principles of image processing is proposed to perform the analysis of pyrite/minerals liberation of coal. To make the automated image analysis system possible, a data base of the light reflectance characteristics of different coal constituents must be established and implemented into a computer program. Characterization of coal images through the analysis of histograms has been conducted. To be specific, our research effort, up to this quarter, has led to (1) the development of a technique to group clusters of pixels (appeared in a coal image) into different particles, (2) the development of the gray level averaging technique for the identification of different materials in coal, (3) development of additional criteria for material classification when the analysis of coal particles based on the gray level data fails. Based on these developments, an image analysis computer program has been established. The initial verification of this program has indicated that the automated image analysis process is possible.

0104 Processing

Refer also to citation(s) 32134, 32151, 32197, 32212, 32226, 32329, 32675, 32752, 32754, 33107, 33295, 33325, 33327

32154 (BNL–49193) **Catalysis and clean environment: What do these two have in common?.** Mahajan, D.; Gupta, N.; Kobayashi, A. Brookhaven National Lab., Upton, NY (United States). [1993]. 11p. Sponsored by USDOE, Washington, DC (United States); Electric Power Research Inst., Palo Alto, CA (United States). DOE Contract AC02-76CH00016. (CONF-9306204–1: Project energy '93, Kansas City, MO (United States), 21-23 Jun 1993). Order Number DE93017608. Source: OSTI; NTIS; GPO Dep.

The theme of the 1990s, "Continual Expansion through Sustainable Development," is the outcome of interdisciplinary studies undertaken in the preceding two decades to arrest ongoing global environmental deterioration. A critical component of various international efforts to formulate and implement environmentally-sound technologies is the planned involvement of developing countries and countries with economies in-transition which are poised for explosive growth well into the twenty-first century but do not have policies or financial resources to simultaneously manage their environment. Though CO_2-producing, technologies utilizing relatively abundant and inexpensive carbon-based feedstocks will still play a major role on the scene. Related to this, the aim of the ongoing effort at Brookhaven National Laboratory is to develop technologies for enhancing natural gas and coal usage through liquid phase catalysis. A successful application of this concept in the synthesis of oxygenates is described. The potential impact of this activity on methanol-energy, non-petroleum feedstocks development, H_2-energy, CO_2-recycle, and several other areas in relation to CO_2-mitigation, is also discussed.

32155 (CONF-930904–5) **Influence of restricted diffusion on retrogressive free-radical reactions.** Buchanan, A.C.; Britt, P.F. III; Thomas, K.B. Oak Ridge National Lab., TN (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 7. international coal science conference; Banff (Canada); 12-17 Sep 1993. Order Number DE93017757. Source: OSTI; NTIS; GPO Dep.

The effects of restricted mass transport on retrogressive reaction pathways can be probed through the study of model compounds immobilized on silica surfaces. Silica-immobilized bibenzyl undergoes a free radical chain rearrangement reaction that converts the thermally labile bibenzylic linkage into a more refractory diphenylmethane-type linkage. The efficiency of this process was found to be quite sensitive to the structure of neighboring molecules on the surface. Co-immobilized naphthalene was more effective that co-immobilized tetralin (a hydrogen donor) in inhibiting the process, apparently by retarding the key hydrogen atom transfer step. The effect of the co-attached molecules on the retrogressive cyclization-dehydrogenation path as well as other reaction pathways for this complex system remain under investigation.

32156 (DOE/FTR–93017255) **Travel to England for exchange of information on direct coal liquefaction: Foreign trip report, December 9–16, 1992.** Gray, D. Sandia National Labs., Albuquerque, NM (United States). 15 Jan 1992. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93017255. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This trip report summarizes the proceedings of the First Joint Workshop on Coal Liquefaction held at the British Coal Direct Liquefaction pilot plant at Point-of-Ayr, in Ffynnongroew, North Wales on December 12 and 13, 1991. British Coal is developing a coal liquefaction process called the Liquid Solvent Extraction (LSE) process in which coal is reacted with solvent at temperature to produce a coal extract. This extract is filtered from the ash and unconverted coal and hydrocracked in ebullating bed reactors to produce distillate liquids that can then be upgraded into transportation fuels. British Coal with financial support from the European Community, the UK Department of Energy, and others have built a 2.5 ton per day pilot plant to prove the concept of the LSE process.

32157 (DOE/FTR–93018610) **Travel to Poland to review the desulfurization of coals using pyrolysis project which is being conducted at the Institute for Chemical Processing of Coal: Foreign trip report, June 16–26, 1991.** Johnson, R.A. USDOE, Washington, DC (United States). 10 Sep 1991. 27p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93018610. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The primary purpose of the trip was for Dr. Richard Johnson, as DOE/METC's appointed comanager, to review the status of the project titled "Desulfurization of Coals Using Pyrolysis" which is being conducted at the Institute for Chemical Processing of Coal (ICPC) in Zabrze, Poland, and is supported by the Marie Sklodowska Curie II Fund, which is managed by the US-Poland Joint Commission on Scientific and Technical Cooperation. The project has progressed very well and has been quite productive. The pyrolysis process with dolomite for sulfur capture coupled with char combustion has been demonstrated in a process development unit (250 kg/hr coal feed) and achieved up to 80 percent SO_2 reduction, with room for further improvement. A process economic study for retrofitting a pulverized coal-fired power plant should be done. The ICPC is also developing a circulating fluid-bed coal pyrolysis process for producing smokeless fuel or for combined cycle power generation systems, and is constructing a pilot plant with a coal feed rate of 200 metric tons per day.

32158 (DOE/MC/11076–3435) **Oil shale, tar sand, coal research, advanced exploratory process technology, jointly sponsored research: Quarterly technical progress report, January–March 1993.** Western Research Inst., Laramie, WY (United States). [1993]. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-86MC11076. Order Number DE93040679. Source: OSTI; NTIS; GPO Dep.

Accomplishments for the past quarter are briefly described for the following areas of research: oil shale; tar sand; coal; advanced exploratory process technology; and jointly sponsored research. Oil shale and tar sand researches cover processing studies. Coal research includes: coal combustion; integrated coal processing concepts; and solid waste management. Advanced exploratory process technology covers: advanced process concepts; advanced mitigation concepts; and oil and gas technology. Jointly sponsored research includes: organic and inorganic hazardous waste stabilization; CROW™ field demonstration with Bell Lumber and Pole; development and validation of a standard test method for sequential batch extraction fluid; operation and evaluation of the CO_2 HUFF-N-PUFF Process; fly ash binder for unsurfaced road aggregates; solid-state NMR analysis of Mesaverde Group, Greater Green River Basin tight gas sands; characterization of petroleum residue; shallow oil production using horizontal wells with enhanced oil recovery techniques; surface process study for oil recovery using a thermal extraction process; oil field waste cleanup using tank bottom recovery process; remote chemical sensor development; in situ treatment of manufactured gas plant contaminated soils demonstration program; solid-state NMR analysis of naturally and artificially matured kerogens; and development of an effective method for the clean-up of natural gas.

32159 (DOE/MC/23075–3391) **Measurement and modeling of advanced coal conversion processes: Twenty-seventh quarterly report, April 1, 1993–June 30, 1993.** Solomon, P.R. (Advanced Fuel Research, Inc., East Hartford, CT (United States)); Serio, M.A.; Hamblen, D.G.; Smoot, L.D.; Brewster, B.S. Advanced Fuel Research, Inc., East Hartford, CT (United States); Brigham Young Univ., Provo, UT (United States). [1993]. 85p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-86MC23075. Order Number DE93040350. Source: OSTI; NTIS; GPO Dep.

Significant advances have been made at Brigham Young University (BYU) in comprehensive two-dimensional computer codes for mechanistic modeling of entrained-bed gasification and pulverized coal combustion. During the same time period, significant advances have been made at Advanced Fuel Research, Inc. (AFR) in the mechanisms and kinetics of coal pyrolysis and secondary reactions of pyrolysis products. This program presents a unique opportunity to merge the technology developed by each organization to provide detailed predictive capability for advanced coal

characterization techniques in conjunction with comprehensive computer models to provide accurate process simulations. The program will streamline submodels existing or under development for coal pyrolysis chemistry, volatile secondary reactions, tar formation, soot formation, char reactivity, and SO_x-NO_x pollutant formation. Submodels for coal viscosity, agglomeration, tar/char secondary reactions, sulfur capture, and ash physics and chemistry will be developed or adapted. The submodels will first be incorporated into the BYU entrained-bed gasification code and subsequently, into a fixed-bed gasification code (to be selected and adapted). These codes will be validated by comparison with small scale laboratory and PDU-scale experiments. Progress is described.

32160 (DOE/MC/24167–3393) **Rawlins UCG Demonstration Project: Final technical progress report, January 1, 1987–February 9, 1988.** Energy International Corp., Pittsburgh, PA (United States). 3 Aug 1988. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-88MC24167. (EI–0788-017). Order Number DE93040351. Source: OSTI; NTIS; GPO Dep.

Department of Energy Participation in the Rawlins UCG Demonstration Project began officially on November 9, 1987. Even though their financial participation began at this time, they will receive technical information from the start of the project which was on January 1, 1987. The Rawlins UCG Demonstration Project is progressing in Phase I with the majority of the emphasis on facility design, site characterization and the environmental work. The site characterization field work is estimated to be completed by the end of February with the final report completion towards the end of Phase I. The facility design effort is close to the 40% level. It is anticipated that all permits will be applied for in Phase I and most of them will be granted by the end of Phase I. The obtaining of the private financing continues to be a major activity in the project. All of the financing must be in place before the continuation for DOE funding to Phase II will be applied for.

32161 (DOE/MC/24167–3417) **[Underground gasification of steeply dipping coal beds]: [Quarterly report, February 10, 1988–May 9, 1988].** Energy International, Inc., Rawlins, WY (United States). [1988]. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-88MC24167. Order Number DE93040357. Source: OSTI; NTIS; GPO Dep.

The Rawlins UCG Demonstration Project is progressing in Phase 1 with the majority of the emphasis on facility design, site characterization and the environmental work. The site characterization field work was completed in February with the interpretation, analysis, and final report to be completed towards the end of Phase 1. The facility design effort continues and is well beyond the 40% level. It is anticipated that all permits will be applied for in Phase 1 and most of them will be granted by the end of Phase 1. Significant changes in the scope of the project were requested during this period and are under review. A request was made to eliminate urea production, make ammonia the primary product, and add cogeneration. An extension of Phase 1 and rescheduling of project deliverables were requested to accommodate the needs for private financing. The obtaining of the private financing continues to be a major activity in the project. All of the financing must be in place before the continuation application for DOE funding to Phase 2 will be submitted.

32162 (DOE/PC/89865–T8) **Synthesis of dimethyl ether and alternative fuels in the liquid phase from coal-derived synthesis gas: Final technical report.** Air Products and Chemicals, Inc., Allentown, PA (United States). Feb 1993. 98p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90PC89865. Order Number DE93018885. Source: OSTI; NTIS; GPO Dep.

Through the mid-1980s, Air Products has brought the liquid phase approach to a number of other synthesis gas reactions where effective heat management is a key issue. In 1989, in response to DOE's PRDA No. DE-RA22-88PC88805, Air Products proposed a research and development program entitled "Synthesis of Dimethyl Ether and Alternative Fuels in the Liquid Phase from Coal Derived Syngas." The proposal aimed at extending the LP-MEOH experience to convert coal-derived synthesis gas to other useful fuels and chemicals. The work proposed included development of a novel one-step synthesis of dimethyl ether (DME) from syngas, and exploration of other liquid phase synthesis of alternative fuel directly from syngas. The one-step DME process, conceived in 1986 at Air Products as a means of increasing syngas conversion to liquid products, envisioned the concept of converting product methanol in situ to DME in a single reactor. The slurry reactor based liquid phase technology is ideally suited for such an application, since the second reaction (methanol to DME) can be accomplished by adding a second catalyst with dehydration activity to the methanol producing reactor. An area of exploration for other alternative fuels directly from syngas was single-step slurry phase synthesis of hydrocarbons via methanol and DME as intermediates. Other possibilities included the direct synthesis of mixed alcohols and mixed ethers in a slurry reactor.

32163 (DOE/PC/90293–T9) **High temperature membranes for H_2S and SO_2 separations: Quarterly progress report, January 1, 1993–March 31, 1993.** Winnick, J. Georgia Inst. of Tech., Atlanta, GA (United States). School of Chemical Engineering. [1993]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90293. Order Number DE93019783. Source: OSTI; NTIS; GPO Dep.

High temperature membrane separation techniques have been applied to gas mixtures involved in coal utilization. For coal gasification, H_2S has been removed from the syn-gas stream, split into hydrogen which enriches the syn-gas, and sulfur which can be condensed from an inert gas sweep stream. For coal combustion, SO_2 has been separated from the flue gas, with concentrated SO_3 produced as a by-product. Both processes appear economically viable but each requires fundamental improvements; both the H_2S and SO_2 cells require more efficient membranes and the H_2S cell needs a more efficient anode. Membranes will be fabricated by either hotpressing, impregnation of sintered bodies, or tape casting. Research conducted during the present quarter is highlighted, with an emphasis on progress toward these goals. Membranes tested for SO_x removal and H_2S were Si_3N_4 and zirconia, respectively.

32164 (DOE/PC/91039–T6) **Highly dispersed catalysts for coal liquefaction: Quarterly report No. 6, November 23, 1992–February 22, 1993.** Hirschon, A.S.; Wilson, R.B. SRI International, Menlo Park, CA (United States). 28 May 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC91039. Order Number DE93018896. Source: OSTI; NTIS; GPO Dep.

The objectives of this project are to study the effect of pretreatment methods on the two-stage liquefaction process. In particular the effects of dispersed catalysts and carbon monoxide atmospheres on a coal liquefaction process. The project is divided into three technical tasks. Task 1 and 2 deal with the analyses and liquefaction experiments, respectively, whereas Task 3 deals with the economic impact of utilizing the pretreatment methods. This quarter concentrated on Tasks 1 and 2. which are summarized below. The fractionated products from the coal liquefaction experiments conducted in Task 2 exhibited a very low H/C ratio, most likely due to the low H/C ratio of the Black Thunder recycle vehicle used in these liquefaction experiments. Wilsonville has reported the recycle vehicle as approximately 20% distillable material (1100°F at one atmosphere), 20% insoluble material (CI) and 40% resid. We are now in the process of fractionating this material in order to determine its contribution to our liquefaction results. We also analyzed some of the sulfated iron catalysts for surface areas, finding that the calcined catalyst had surface areas of 76 m^2/g, compared to 6 m^2/g for the iron oxide used by Wilsonville. We also synthesized two more catalysts, the sulfated iron catalyst, and a thiolato iron carbonyl catalyst. We hope to be able to screen these catalysts for liquefaction experiments in the 300 mL autoclaves during the next quater. This quarter we studied iron carbonyl as a catalyst using atmospheres of hydrogen and of hydrogen and carbon monoxide at total cold pressures of 1000 psia. The comparisons are not yet completed, but it appears that pure hydrogen gave slightly higher conversions into preasphaltenes, but similar conversions into asphaltenes and oils.

32165 (DOE/PC/91040–21) **Advanced direct liquefaction concepts for PETC generic units: Quarterly technical progress**

report, October 1992–December 1992. Kentucky Univ., Lexington, KY (United States). Center for Applied Energy Research; Sandia National Labs., Albuquerque, NM (United States); CONSOL, Inc., Pittsburgh, PA (United States); LDP Associates (United States). Feb 1993. 142p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC91040. Order Number DE93018921. Source: OSTI; NTIS; GPO Dep.

The reactivity of the THF insoluble fraction of the ashy resid component of Wilsonville recycle oil (WRO) during liquefaction of Black Thunder coal in tetralin was determined at 415°C and 60 minutes. The liquefaction runs were made by combining this material with Black Thunder coal at the same ratio used in the WRO coal runs. THF conversion and product distribution from liquefaction in tetralin in the presence of the THF insoluble fraction of the ashy resid were similar to results from liquefaction in WRO. THF conversion was greater than loot with an oil yield that was somewhat higher than in WRO. Differences in HC gas yield and H_2 consumption were slight, while conversion and product distribution from liquefaction of Black Thunder coal in tetralin or in the WRO distillate were quite different. In both these solvents the 85–86% THF conversions were less than for runs in which the THF insoluble fraction of the ashy resid was present. This establishes that the THF insoluble fraction of the ashy resid is the reactive fraction of the WRO.

32166 (DOE/PC/91288–T8) **High temperature electrochemical separation of H_2S from coal gasification process streams: Quarterly progress report, October 1, 1992–December 30, 1992.** Winnick, J. Georgia Inst. of Tech., Atlanta, GA (United States). School of Chemical Engineering. [1992]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91288. Order Number DE93040633. Source: OSTI; NTIS; GPO Dep.

Experimentation with a rigidized, electrolyte filled tile, left much to be desired. The instability of the tiles at molten conditions (> 550°C), provided the necessary mechanism for H_2 to penetrate the membrane. Once H_2 cross-over occurs the entire objective of electrochemical separation becomes nullified. The Zircar membranes used last quarter provided excellent protection against H_2, prompting a reversion back to them. If porosities are strictly adhered to and the water-gas shift is properly handled, the membranes should provide an adequate mechanism for selective H_2S removal.

32167 (DOE/PC/91310–T6) **The use of solid-state NMR techniques for the analysis of water in coal and the effect of different coal drying techniques on the structure and reactivity of coal: Quarterly report, March 1–May 31, 1993.** Netzel, D.A. University of Wyoming Research Corp., Laramie, WY (United States). Western Research Inst. [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91310. Order Number DE93040710. Source: OSTI; NTIS; GPO Dep.

The overall objectives of this study are to develop an NMR method for measuring the water in coal, to measure the changes in coal structure that occur during coal drying, to determine what effect water has on retrograde/condensation reactions, and to determine the mechanism by which water may impact coal reactivity toward liquefaction. Different methods of drying are being investigated to determine if drying can be accomplished without destroying coal reactivity toward liquefaction. The objectives for this quarterly report period were to (1) determine the kinetics of chemical dehydration of coals, (2) measure the volumetric, swelling ratio for initial and dried coals, and (3) determine the coal liquefaction yield for dried coals.

32168 (DOE/PC/92521–T38) **Microbial strain improvement for organosulfur removal from coal: [Quarterly] technical report, March 1, 1993–May 31, 1993.** Kilbane, J.J. II (Inst. of Gas Technology, Chicago, IL (United States)). Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019788. Source: OSTI; NTIS; GPO Dep.

IGT has developed a microbial culture Rhodococcus rhodochrous, designated as IGTS8, that is of specifically cleaving carbon-sulfur bonds in a range of organosulfur model compounds and is capable of removing organic sulfur from coal and petroleum without significantly sacrificing the calorific value of the fuel. Although IGTS8 possesses the ability to specifically remove organic sulfur from coal, a major research need is to develop improved strains of microorganisms that possess higher levels of desulfurization activity and therefore permit favorable biodesulfurization process conditions. During the past quarter, promoter probe vectors thought to possess promoter inserts were isolated. Two new promoter probe vectors were constructed: pRCAT2; which is pRAT1 (second quarterly report) with the BamHI site removed, and pRCAT3; which is pRCAT2 with a synthetic oligonucleotide inserted at the HindIII site that will allow a wider range of restriction fragments to be examined for promoter activity including the fragments from the twenty mutants isolated from the Rhodococcus strains exhibiting increased resistance to chloramphenicol. Sequence analysis of six of these mutants has been initiated, computer comparisons made, and base change confirmation is in progress. As research to isolate strong Rhodococcus promoters is the goal, the promoter for the 16S ribosomal RNA structural gene is a good candidate for a strong promoter based on analyses of the 16S RNA gene in other species. Since the sequence of the 16S RNA gene is well conserved among species, straightforward techniques are available to isolate the promoter and such efforts are in progress.

32169 (DOE/PC/92521–T39) **Sulfur removal from high-sulfur Illinois coal by low-temperature perchloroethylene (PCE) extraction: [Quarterly] technical report, March 1, 1993–May 31, 1993.** Chou, M.I.M. (Illinois State Geological Survey, Champaign, IL (United States)); Buchanan, D.H.; Stucki, J.W. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019789. Source: OSTI; NTIS; GPO Dep.

The purposes of this project are: to independently confirm and possibly to improve the organic sulfur removal from Illinois coals with the PCE process developed by the Midwest Ore Processing Co. (MWOPC), to verify the forms-of-sulfur determination using the ASTM method for evaluation of the PCE process, and to develop a dechlorination procedure to remove excess PCE from the PCE-treated coal. The objectives for the second year are: to verify the possible effects of PCE treatment on coal-derived FeS_2, $FeSO_4$, and $Fe_2(SO_4)_3$ on ASTM coal analysis, to investigate the behavior of sulfur during oxidation and PCE desulfurization using the isotopically signatured coal sample, to investigate the effects of conditions and/or reagents on the oxidation of the organic-sulfur-model compounds, to evaluate the extended oxidation condition on the organic sulfur removal by PCE desulfurization, and to study other innovative pretreatment processes for the removal of organic sulfur from coal under mild conditions.

32170 (DOE/PC/92521–T48) **Behavior of sulfur and chlorine in coal during combustion and boiler corrosion: [Quarterly] technical report, March 1–May 31, 1993.** Chou, C.L. (Illinois State Geological Survey, Champaign, IL (United States)); Hackley, K.C.; Cao, J.; Moore, D.M.; Xu, J.; Ruch, R.R.; Pan, W.P.; Upchurch, M.L.; Cao, H.B. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019798. Source: OSTI; NTIS; GPO Dep.

The evolution of HCl during coal pyrolysis and its relation to chlorine forms in raw coal were studied using a temperature-programmed pyrolysis and gas combustion in conjunction with a quadrupole gas analyzer (QGA). Using a new filament source in the QGA significantly improved the sensitivity of HCl detection. The major peak at 445°C showed an increased intensity and a new HCl evolution peak at 600°C was observed during pyrolysis of Illinois coal IBC-109. Pyrolysis of coal IBC-109 spiked with NaCl solution showed a strong peak of HCl evolution above 700°C. In the study of boiler deposits, several sample preparation procedures for X-ray diffraction analysis were developed and six minerals were unambiguously determined in superheater and heater deposits from a power plant in Illinois. Effects of composite gases containing 0.2% HCl on six metals were tested at 600°C and 200°C, and at 100°C with moisture for 400 hours. Similar tests were conducted with a composite gas containing no HCl at 600°C and 200°C. The results allow us to assess the factors controlling the corrosion rate:

Boiler materials, temperature, concentration of HCl in combustion gases, and chloride condensate on metal surfaces.

32171 (DOE/PC/92521–T55) **Integrated production/use of ultra low-ash coal, premium liquids and clean char: [Quarterly] technical report, March 1, 1993–May 31, 1993.** Kruse, C.W. (Illinois State Geological Survey, Champaign, IL (United States)); Carlson, S.L.; Fatemi, M.; Snoeyink, V.L.; Feizoulof, C.A.; Klavetter, E. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019805. Source: OSTI; NTIS; GPO Dep.

Tests this quarter showed the adsorption efficiency of an oxidized activated ChemCoal™ (OACC) char for removing volatile organic compounds (VOCs) from spiked water is higher than for unoxidized activated char (ACC). OACC destroyed (or reacted with) a higher percentage of VOCs when loaded char was heated quickly to 850°C. This was expected based on the OACC's superiority as an elimination catalyst. Aromatic VOCs appeared to be adsorbed on the chars more readily than the chlorinated ones but the multichlorinated VOCs appeared to be adsorbed more strongly. The performance of two oxidized carbons (OST3-9 and OACC chars) for the removal of the VOCs from two industrial waste waters spiked with VOCs appeared similar. The more active catalyst, OST3-9 appeared more effective than OACC in destroying the adsorbed materials. A series of carbons having differing levels of oxygen on the surface was prepared by desorbing oxygen from the surface placed there by nitric acid oxidation. Tests revealed that the capacity to adsorb 2-nitrophenol increased as the outgassing temperature was increased. This indicates that PNP adsorption is increased as surface oxygen is removed from the carbon.

32172 (DOE/PC/92521–T56) **Investigation of a sulfur reduction technique for mild gasification char: [Quarterly] technical report, March 1–May 31, 1993.** Knight, R.A. (Institute of Gas Technology, Chicago, IL (United States)). Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019806. Source: OSTI; NTIS; GPO Dep.

The objective of this program is to investigate the desulfurization of mild gasification char using H_2:CH_4 mixtures. Mild gasification of coal produces char, liquids, and gases at 1000°–1500°F and near-ambient pressure. Char, comprising 60–70% of the product, can be used to make high-value form coke for steel making and foundries. However, a sulfur content below 1 wt% is desirable, and char from high-sulfur Illinois coals must be upgraded to meet this criterion. Illinois No. 6 chars were treated in a batch fluidized bed with H_2:CH_4 blends containing 9–24 vol% CH_4 at 1100°–1600°F and 50–200 psig. Sulfur removal up to 92.5 wt% were obtainer, and the char desulfurization susceptibility was related to porosity, density, and crystallite size. The relationships among mild gasification parameters, char properties, and char desulfurization susceptibility are being studied. Acid washing of coal to remove Ca and Fe is being explored for its effect on subsequent sulfur removal, and secondary desulfurization of form coke produced from the desulfurized chars is also being studied. Desulfurization tests of entrained and fluidized-bed reactor chars from IBC-105 coal (4.1–4.3 wt% sulfur) were completed. Desulfurization conditions were 1400°F, 100–200 psig and reactant gas compositions of 15-49 vol% CH_4 in H_2. Sulfur removal ranged from 28 to 95%, with carbon losses from 5 to 29%. Acid-washing of the coal prior to mild gasification or the char prior to desulfurization increased its susceptibility to desulfurization, with sulfur content reduced to as low as 0.10 wt% dry char. Fluidized-bed chars were easier to desulfurize than entrained chars, and were less affected by acid-washing.

32173 (DOE/PC/92521–T57) **Mild temperature gasification: Partitioning sulfur to gas as H_2S: [Quarterly] technical report, March 1–May 31, 1993.** Stencel, J.M. (Kentucky Univ., Lexington, KY (United States). Center for Applied Energy Research); Neathery, J.K.; Schaefer, J.L.; Yang, Jidong. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019807. Source: OSTI; NTIS; GPO Dep.

Bench-scale, mild temperature fluidized bed gasification (MTFBG) will be performed on three high sulfur Illinois basin coals after mixing with phosphoric acid. The research initiates development of an advanced processing technology which partitions coal sulfur to the gas phase as H_2S. Influences of coal type, coal agglomeration, and steam injection on the properties of the solid, condensible and gaseous products produced during MTFBG will be examined. Analytical measurements of the products will be obtained and are designed to provide product quality and quantity data. Combustion reactivity testing of the char, and pressurized, hot water extraction of H_3PO_4 from the char, will be performed to provide information for design of a continuous and integrated process for the removal and recovery of coal sulfur. MTFBG experiments were performed on Illinois coals IBC-101, -106 and -110. The yields of char, tar and gaseous products varied between 60–85% char, 0.4–1.3% tar, and 15–43% gas for IBC-101 and -106. Gas yields were sensitive to the coal/phosphoric acid mixing ratio and also dependent on the residence time within the gasifier. The mean residence time was low (~6 seconds), and was influenced by the mean particle size of the coals. The total sulfur removal was as high as 83% for IBC-106 at a temperature of 500°C. In comparison with previous fixed bed testing, it is believed that the sulfur is removed as H_2S. Experiments planned for the next quarter should define the concentration and type of sulfur in the gas.

32174 (DOE/PC/92521–T58) **Biodesulfurization of mild gasification liquid products: [Quarterly] technical report, March 1, 1993–May 31, 1993.** Kilbane, J.J. II (Institute of Gas Technology, Chicago, IL (United States)). Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019808. Source: OSTI; NTIS; GPO Dep.

The mild gasification of coal is a promising new technology that can convert coal to multiple products: gas, solid, and liquids. However, the sulfur content and aromaticity of mild gasification liquids limits their usefulness. Biodesulfurization can potentially decrease both sulfur content and aromaticity. The objective of this project is to investigate the feasibility of using biodesulfurization to upgrade the quality of mild gasification liquids. Previously it was shown that the middle distillate (360–440°F) fraction of liquids derived from the mild gasification of coal could be biodesulfurized. During this quarter it was demonstrated that unfractionated liquids can be biodesulfurized. Moreover, it was demonstrated that lysed cell preparations and freeze-dried cells can be used to biodesulfurize mild coal gasification liquids. The importance of the finding that freeze-dried biocatalysts can be used to biodesulfurize mild coal gasification liquids is that freezedried cells can be produced at one location, stored indefinitely, and then shipped to another location for coal biodesulfurization. Moreover, freeze-dried biocatalysts can be added directly to mild coal gasification liquids with only minimal additions of water so that reactor volumes can be minimized.

32175 (DOE/PC/92521–T59) **Upgrading mild gasification liquids to produce electrode binder pitch: [Quarterly] technical report, March 1–May 31, 1993.** Knight, R.A. (Institute of Gas Technology, Chicago, IL (United States)). Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019809. Source: OSTI; NTIS; GPO Dep.

The objective of this program is to investigate the production of electrode binder pitch from mild gasification liquids. The IGT MILDGAS process pyrolyzes coal in a 1000°–1500°F(538°–816°C) fluidized/entrained bed to produce solid, gas, and liquid co-products. With Illinois coal, the 750°F+ (400°C+) distillation residue (crude pitch) comprises 40–70% of the MILDGAS liquids, representing up to 20 wt% of feed coal. The largest market for pitch made from coal liquids is the aluminum industry, which uses it to make carbon anodes f or electrolytic furnaces. In this project, crude pitch from the DOE-sponsored MILDGAS process research program is being modified by a flash thermocracking technique to achieve specifications typical of a binder pitch. A pitch thermocracking unit has been constructed for operation at 1200°–1800°F (650°–982°C). Atomization of the pitch at the thermocracker inlet

is being examined as a method of optimizing the particle size of polymerized pitch components. Four successful thermocracking tests were performed with a crude Illinois No. 6 pitch from 1110°F MILDGAS PRU runs. Key pitch properties improved in all cases, with higher temperatures resulting in increased softening point (187–273°F), QI (1.6–15.7%), TI (18–41%), coking value (38–55%), C/H ratio (1.17–1.57), and density (1.18–1.26).

32176 (DOE/PC/92521–T64) **Development of novel copper-based sorbents for hot-gas cleanup: [Quarterly] technical report, March 1, 1993–May 31, 1993.** Hill, A.H. (Institute of Gas Technology, Chicago, IL (United States)); Abbasian, J.; Flytzani-Stephanopoulos, M.; Li, Li. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019814. Source: OSTI; NTIS; GPO Dep.

The objective of this investigation is to evaluate two novel copper-based sorbents (i.e. copper-chromium and copper-cerium) for their effectiveness in removing hydrogen sulfide from fuel gas in the temperature range of 650° to 850°C. In this program, structural and kinetic studies are conducted on various compositions of the two selected copper-based sorbents to determine the optimum sorbent composition. The effect of operating conditions on the performance of the sorbents alone with the stability and regenerability of the selected sorbents in successive sulfidation/regeneration operation are determined. Parametric multicycle desulfurization tests were conducted this quarter in a bench-scale (5-cm-diameter) quartz reactor at one atmosphere using the $CuCr_2O_4$ and CuO/CeO_2 sorbents. The parameters studied included temperature, space velocity, and feed gas composition. Both sorbents were able to reduce the H_2S concentration of the reactor feed gas to <10 ppM under all conditions tested. The apparent reactivity of the CuO/CeO_2 sorbent was lower after the first cycle which may be attributed to incomplete regeneration caused by sulfate formation.

32177 (DOE/PC/92521–T65) **An attrition-resistant zinc titanate sorbent for sulfur: [Quarterly] technical report, March 1, 1993–May 31, 1993.** Swisher, J.H. (Southern Illinois Univ., Carbondale, IL (United States). Dept. of Mechanical Engineering and Energy Processes). Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019815. Source: OSTI; NTIS; GPO Dep.

In the continuing search for good sorbent materials to remove sulfur from hot, coal-derived gases, zinc titanate sorbents have shown great promise. The objective of this project is to extend the work of prior investigators by developing improvements in the compressive strength and, therefore, the cycle life of these sorbents without a significant loss in chemical reactivity. During the third quarter, the preparation and properties of sorbents with a nominal composition of 50% Zn_2TiO_4 and 50% TiO_2 were studied. In differential thermogravimetric tests of reactivity, specimens sintered at 850 and 900°C both gave two identical sulfidation-regeneration cycles. Specimens sintered at lower temperatures showed evidence of degradation during the second cycle. Materials of this composition had lower crush strengths than for the composition 75% Zn_2TiO_4 – 25% TiO_2 reported earlier, but higher values than reported by other investigators. Future work will include the preparation and properties of a lot of material with a coarser structure and larger pores, and microscopic studies on all three lots of material.

32178 (DOE/PC/92521–T66) **Stabilization of spent sorbents from coal gasification: [Quarterly] technical report, March 1–May 31, 1993.** Hill, A.H. (Institute of Gas Technology, Chicago, IL (United States)); Wangerow, J.R. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019816. Source: OSTI; NTIS; GPO Dep.

The objective of this investigation is to determine the kinetics of reactions involving partially sulfided dolomite and oxygen, which is needed for the design of the reactor system for the stabilization of sulfide-containing solid wastes from gasification of high sulfur coals. During this quarter, samples of the partially sulfided dolomite were reacted with oxygen in the fluidized-bed reactor at different operating conditions. The test parameters included the effects of solid residence time, sorbent particle size, and reaction pressure. The reacted solids were analyzed to determine the extent of CaS conversion to $CASO_4$. The results of these tests indicate that the rate of sulfation reaction increases with decreasing sorbent particle diameter and increasing pressure. Classical gas/solid reaction models, including the shrinking core model, the uniform conversion model, and the grainy pellet model, were applied to the experimental data of CaS sulfation. However, none of these models appears to be capable of predicting the measured CaS conversion with acceptable accuracy, indicating that these classical models should be modified to obtain better agreement between experimental and theoretical results.

32179 (LBL–34250) **Fundamental studies of the mechanism of catalytic reactions with catalysts effective in the gasification of carbon solids and the oxidative coupling of methane: Quarterly report, April 1, 1993–June 30, 1993.** Heinemann, H.; Somorjai, G.A.; Perry, D.L. Lawrence Berkeley Lab., CA (United States). [1993]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93019103. Source: OSTI; NTIS; GPO Dep.

The last quarterly report (LBL-33769) summarized results obtained with ternary catalysts; e.g., K-Ca-Ni oxide and K-Ca-Co oxide. It was also shown that chars prepared in e presence of NAOH were more easily gasified than the base char, even if the chars were washed to remove all residual free NAOH. During the present report quarter, three variables were investigated: (1) The effect of varying the atomic ratio of different catalyst components (alkali vs. transition metal); (2) The effect of steam partial pressure and of temperature on the reaction; (3) Determination of activation energy of the reaction over K-Ca-Co oxide. It was also found that if the water (steam) used for gasification contains a small amount of NAOH, gasification rates are greatly improved. Figure 1 shows that the gasification rate improves with increasing Co content of the catalyst, though the differences between different Co contents are relatively small. A very similar effect was observed for different concentrations of Fe^{3+} in KCa-Fe oxide catalysts. Figure 2 presents conversion vs. time plots for gasification of an Ill #6 char (which had been charred in the presence of 0.5% caustic) over a K-Ca-Co oxide catalyst at four temperatures. As expected the gasification rate increases with temperature, although there is little difference between our standard 640°C and 680°C. Figure 3 investigates the effect of partial pressure of water on the conversion using an Ill #6 char (prepared in the presence of 0.5% caustic) and a K-Ca-Co oxide catalyst at 640°C. There is an improvement in rate with increasing water partial pressure.

32180 (LBL–34308) **Structural studies in limestone sulfidation.** Fenouil, L.A.; Lynn, S. Lawrence Berkeley Lab., CA (United States). May 1993. 85p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93019251. Source: OSTI; NTIS; GPO Dep.

Thesis submitted by L.A. Fenouil.

This study investigates the sulfidation of limestone at high temperatures (700–900°C) as the first step in the design of a High-Temperature Coal-Gas Clean-Up system using millimeter-size limestone particles. Several workers have found that the rate of this reaction significantly decreases after an initial 10 to 15% conversion of $CaCO_3$ to CaS. The present work attempts to explain this feature. It is first established that millimeter-size limestone particles do not sinter at temperatures up to the $CaCO_3$ calcination point (899°C at 1.03 bar CO_2 partial pressure). It is then shown that CaS sinters rapidly at 750 to 900°C if CO_2 is present in the gas phase. Scanning Electron Microscope (SEM) photographs and Electron Dispersive Spectroscopy (EDS) data reveal that the CaS product layer sinters and forms a quasi-impermeable coating around the $CaCO_3$ grains that greatly hinders more H_2S from reaching the still unreacted parts of the stone. Moreover, most of the pores initially present within the limestone structure begin to disappear or, at least, are significantly reduced in size. From then on, subsequent conversion is limited by diffusion of H_2S through the CaS layer, possibly by S^{2-} ionic diffusion. The kinetics is then adequately described by a shrinking-core model, in which a sharp

front of completely converted limestone is assumed to progress toward the center of the pellet. Finally, experimental evidence and computer simulations using simple sintering models suggest that the CaS sintering, responsible for the sharp decrease in the sulfidation rate, is surface-diffusion controlled.

32181 (SAND–93-0421C) **Development of hydrous titanium oxide catalysts for upgrading coal liquids.** Lott, S.; Dosch, R. Sandia National Labs., Albuquerque, NM (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9309111–1: 10. annual international Pittsburgh coal conference: coal - energy and the environment, Pittsburgh, PA (United States), 20-24 Sep 1993). Order Number DE93017487. Source: OSTI; NTIS; GPO Dep.

Improved efficiency in direct coal liquefaction processes can be obtained by developing catalysts with better activity, selectivity, and life. In previous exploratory research at Sandia National Laboratories, catalysts prepared via hydrous metal oxide (HMO) ion exchangers have been shown to have potential for application to a number of reactions associated with the conversion of coal to liquid fuels. In the present effort, one member of this class of catalysts, hydrous titanium oxide (HTO), has been developed for use in hydrodesulfurization (HDS) and hydrodenitrogenation (HDN) of coal liquids. The unsupported (or bulk) NiMo-HTO catalyst performed well for HDS/HDN of a coal derived liquid as compared to the benchmark Shell 324 catalyst. The CoMo-HTO, while performing better than the Shell 324 catalyst, did not perform quite as well as the NiMo-HTO. In a side-by-side comparison of supported NiMo-HTO catalysts with commercial counterparts, the supported NiMo-HTO catalysts outperformed the Shell 324 and Amocat 1C catalysts on a weight of Mo basis. On a catalyst weight basis, the NiMo-HTO coated catalyst on a Shell 324 blank under performed Shell 324, while the NiMo-HTO coated catalyst on an Amocat 1C support performed as well as the Amocat 1C catalyst.

32182 (SAND–93-1333C) **Pretreatment of coal and recycle oil for direct liquefaction.** Winschel, R.A. (CONSOL, Inc., Library, PA (United States)); Lancet, M.S.; Robbins, G.A.; Burke, F.P.; Kottenstette, R.J.; Stephens, H.P. Sandia National Labs., Albuquerque, NM (United States); CONSOL, Inc., Library, PA (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789 ;AC22-91PC91040. (CONF-930904–3: 7. international coal science conference, Banff (Canada), 12-17 Sep 1993). Order Number DE93017632. Source: OSTI; NTIS; GPO Dep.

A research and development program is being conducted by the University of Kentucky/Center for Applied Energy Research, Sandia National Laboratories, LDP Associates and CONSOL Inc. to improve current coal liquefaction technology by physical and chemical pretreatments of the coal and recycle oil. These pretreatment steps include: (1) agglomeration of the coal with ash-containing recycle oil to simultaneously reject coal ash and recycle-oil ash, (2) fluid coking of the distillation bottoms (ash-purge) stream and recycle of the coker overhead, (3) dewaxing of the distillate portion of the recycle oil, and (4) low-severity hydrotreatment of the coker overhead and dewaxed oil using hydrogen from an in-situ water-gas shift reaction. These pretreatment steps will remove the ash and unconverted coal, reducing the ash load in the system and simultaneously recovering the maximum amount of organics. Dewaxing and hydrotreatment will yield a high-quality recycle oil distillate. These pretreatment steps are being evaluated technically and economically to develop an improved conceptual liquefaction process. The baseline process to which the improved process will be compared is the Two-Stage Liquefaction Process as it was practiced at the Wilsonville, AL, USA Advanced Coal Liquefaction Test Facility.

0105 Products and By-Products

Refer also to citation(s) 32197, 32237

0106 Properties and Composition

Refer also to citation(s) 32159, 32167, 32212, 32220, 32233

32183 (ANL/CHM/CP–76129) **Gas evolution from coal in sealed glass ampoules.** Vorres, K.S. Argonne National Lab., IL (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920815–26: 204. American Chemical Society (ACS) national meeting, Washington, DC (United States), 23-28 Aug 1992). Order Number DE93018864. Source: OSTI; NTIS; GPO Dep.

Higher rank coals evolve methane, and lower rank coals evolve carbon dioxide with some evolution of both gases for the intermediate ranks. The evolution proceeds over time of years for pulverized coals in sealed ampoules. Gas concentrations are higher above −20 mesh samples than above −100 mesh material. Carbon monoxide is not evolved. The Wyodak sample evolves carbon dioxide approximately linearly with time. The gas evolution sample evolves carbon dioxide approximately linearly with time. The gas evolution seems to be associated with evolution of dissovled species.

32184 (CONF-930413–3) **Adsorption of various alcohols on Illinois No. 6 coal in aqueous solutions.** Kwon, K.C.; Rigby, R.R. Tuskegee Univ., AL (United States). Dept. of Chemical Engineering. [1993]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91283. From 18. international technical conference on coal utilization, slurry technologies and fuel systems; Clearwater, FL (United States); 26-29 Apr 1993. Order Number DE93017121. Source: OSTI; NTIS; GPO Dep.

Hydrophilicity, hydrophobicity and aromacity of Illinois #6 coal in water are relatively determined by evaluating equilibrium physical/chemical adsorption of probe compounds on the coal. Experiments on equilibrium adsorption loadings of various additives on 60–200 mesh Illinois #6 coal (DECS-2; Randolph county) were performed to investigate relatively surface properties of the coal at 25°C. The additives include various alcohols, alkanes and aromatic compounds. The main objectives of this research are to evaluate relatively surface properties of raw coals, treated coals and coal minerals with the inverse liquid chromatography technique, using various probe compounds, to analyze flotation recoveries of coals with a micro-flotation apparatus in order to relate coal floatability to evaluated coal surface properties, and to delineate roles of coal-cleaning/handling additives with the inverse liquid chromatography technique.

32185 (CONF-930802–4) **Introduction of fluorine into coals using N-fluorobenzenesulfonimide.** Hagaman, E.W.; Lee, S.K. Oak Ridge National Lab., TN (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 206. American Chemical Society national meeting; Chicago, IL (United States); 22-27 Aug 1993. Order Number DE93017765. Source: OSTI; NTIS; GPO Dep.

The selective introduction of fluorine into coals is under study as part of a program to define the chemical reactivity of coals through identification of reactive functional groups in the organic matrix of these solid fossil fuels. Recently, the number of reactive sites in coals as function of the strength of the organic indicator base has been determined by the C-methylation of O-methylated coals (1,2). The C-methylation was carried out by treatment of coal with carbanion bases and quenched with $^{13,14}C$ methyl iodide. The structural information derived from C-methylation of coals was limited to the number of reactive sites and an estimate of the methylene/methine site ratio (3). The generation of anions in coals is being repeated and quenched with N-fluorobenzenesulfonimide, 1, (4,5), a versatile electrophilic fluorinating reagent, in order to chemically attach fluorine to the reactive carbon site. The ^{19}F nucleus provides the mechanism, dipole-dipole coupling, to selectively observe the ^{13}C nuclei in its immediate vicinity through the use of ^{1}H-^{13}C-^{19}F double cross polarization (DCP)/MAS ^{13}C NMR. In conjunction with MAS ^{19}F NMR and CP/MAS ^{13}C NMR experiments, the goal is the definition of the reactive sites in sufficient detail to discover the chemical basis for the C-H acidity of the original carbanions.

32186 (CONF-930904–4) **Investigation of oxygen functional groups in low rank coal.** Hagaman, E.W.; Lee, S.K. Oak Ridge National Lab., TN (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 7. international coal science conference; Banff

(Canada); 12-17 Sep 1993. Order Number DE93017766. Source: OSTI; NTIS; GPO Dep.

The distribution of the organic oxygen content of coals among the principal oxygen containing functional groups typically is determined by a combination of chemical and spectroscopic methods (1,2) and results in a classification scheme such as % carboxyl, % hydroxyl, % carbonyl, and % ether. A notable subdivision in this classification scheme is the differentiation of phenols in a coal on the basis of their ortho-substitution pattern (3). Apart from this distinction, the further classification of oxygen into functional group subsets is virtually nonexistent. This paper presents initial experiments that indicate a fuller characterization of oxygen distribution in low rank coal is possible. The experimental approach couples selective chemical perturbation and solid state NMR analysis of the material, specifically, the fluorination of Argonne Premium Coal #8, North Dakota lignite, and spectroscopic examination by high resolution solid state ^{19}F NMR (4). The fluorination reagent is diethylaminosulfur trifluoride (DAST), $(Et)_2NSF_3$, which promotes a rich slate of oxygen functional group interconversions that introduce fluorine into the coal matrix (5). The virtual absence of this element in coals make ^{19}F an attractive NMR nuclei for this application (6). The present experiments use direct detection of the ^{19}F nucleus under conditions of proton (^1H) heteronuclear dipolar decoupling and magic angle spinning (MAS). The ca 300 ppm range of ^{19}F chemical shifts in common carbon-fluorine bonding configurations and high ^{19}F nuclear sensitivity permit the identification of unique and chemically dilute functional groups in the coal milieu. The unique detection of aromatic and aliphatic carboxylic acids and primary and secondary alcohols provide examples of the exquisite functional group detail that is revealed by this combination of techniques.

32187 (DOE/PC/88921–16) **Spin-mapping of coal structures with ESE and ENDOR: Final technical report.** Belford, R.L.; Clarkson, R.B. Illinois Univ., Urbana, IL (United States). 1 Jun 1993. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-88PC88921. Order Number DE93019459. Source: OSTI; NTIS; GPO Dep.

Several kinds of electron paramagnetic resonance (EPR) spectra of coal (including whole coal, separated macerals, density-gradient separated fractions, and treated coals) and of model organic thought to be molecular constituents of coals were acquired and analyzed in order to probe the molecular structure and surface properties of coals and of model systems. Typically, the model compounds under investigation and their analogues are found in coals as stable free radicals which give rise to an EPR signal. In some cases, the model compounds were selected because they have some characteristic, such as a particular functional group or heteroatom which may be found in coals, which fits them to serve as test materials for methods development. Two critical instruments for this work - the W-band EPR spectrometer and the S-band ESE spectrometer - were built in this laboratory and were both further developed as part of this project. The ENDOR spectrometer also has been improved. During the course of this project, the W-band EPR system has proven to be the most fruitful tool for probing the chemical structures of coal with the ESE system providing the most valuable auxiliary data. The following report summarizes highlights of these studies. It provides some background, rationale, and selected data and results. Finally, a list of papers and presentations is provided together with abstracts of all of them.

32188 (DOE/PC/90258–T12) **Characterization and supply of coal based fuels: Quarterly report, November 1, 1986–January 31, 1987.** Energy International, Inc., Pittsburgh, PA (United States). Mar 1987. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-86PC90258. Order Number DE93019447. Source: OSTI; NTIS; GPO Dep.

Under the Department of Energy's Advanced Combustor Technology Program, approximately 11 combustor contractors (under 13 contracts) are developing combustion systems (during 1987–1989) for use in residential, commercial, light industrial and industrial retrofit markets. Sufficient quantities of well-characterized, coal-based fuels possessing specific, appropriate specifications are required by the contractors. Fuels may be dry pulverized coal or coal liquid fuels. In support of these equipment development efforts, the team of Energy International and Dravo Engineers will provide such fuels. During the first quarter of this contract effort, the primary activities were involved with: (1)"Analysis of Fuel Needs" which includes a market analysis, a resource assessment, and development of specifications for fuels. (2) Completing the initial version of those analyses and reviewing the preliminary coal selection recommendations with DOE-PETC project management. (3) Initiating the procurement of coal supplies for initial candidates. (4) Determination of supply requirements (i.e., specifications, quantities, schedule) with combustor developers. (5) Development and scoping of coal supply and process strategies. The progress on the above activities is reported here. The major coal fields of the US were reviewed to correlate with the market needs analysis. The coals selected for developmental testing will need to satisfy the most stringent fuel requirements and stretch the fuel processing (deep cleaning) capabilities beyond the current state-of-the-art.

32189 (DOE/PC/90308–9) **A new model of coal-water interaction and relevance for dewatering: Quarterly technical progress report, 1 September–30 November 1992.** Suuberg, E.M. Brown Univ., Providence, RI (United States). Div. of Engineering. [1992]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90308. Order Number DE93019781. Source: OSTI; NTIS; GPO Dep.

The picture that emerges is that there are quite large heat effects associated with low uptakes of solvents by the coal. The fact that the heat of wetting decreases dramatically with uptake has been illustrated many times. The final equilibrium uptake of solvent in a swollen coal probably takes place at near zero partial molar enthalpy of mixing, as we have argued earlier. It would, however, be interesting to establish what sorts of interactions give rise to the high initial heats of mixing. The trend of increasing heat of mixing with increasing temperature has also been earlier noted. It too is not yet understood.

32190 (DOE/PC/90308–10) **A new model of coal-water interaction and relevance for dewatering: Quarterly technical progress report, 1 December–28 February 1993.** Suuberg, E.M. Brown Univ., Providence, RI (United States). Div. of Engineering. [1993]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90308. Order Number DE93040614. Source: OSTI; NTIS; GPO Dep.

This project is concerned with a basic scientific question concerning the properties of coal- to what extent is the ability of coal to hold moisture a manifestation of the well-known ability of coal to swell, when exposed to good solvents? This quarter's efforts involved continuing to use the flow microcalorimeter as a tool for characterizing the heat effects involved in interaction of swelling solvents and coals. These data are of relevance to the overall project goal of establishing that moisture retention is a solvent swelling process. During this quarter, we used the flow microcalorimeter to explore heat effects as a function of concentration of solute. Earlier results had strongly suggested that the heat effect is large in going from zero to small concentrations, but that once the concentration was above a low levels, there would be relatively small effects of concentration.

32191 (DOE/PC/91296–7) **Advanced NMR-based techniques for pore structure analysis of coal: Quarterly report No. 7, April 1, 1993–June 31, 1993.** Smith, D.M. New Mexico Univ., Albuquerque, NM (United States). Center for Micro-Engineered Ceramics. [1993]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91296. Order Number DE93019780. Source: OSTI; NTIS; GPO Dep.

One of the main problems in coal utilization is the inability to properly characterize its complex pore structure. Coals typically have micro/ultramicro pores but they also exhibit meso and macroporosity. Conventional pore size techniques (adsorption/condensation, mercury porosimetry) are limited because of this broad pore size range, microporosity, reactive nature of coal, samples must be completely dried, and network/percolation effects. Small angle scattering is limited because it probes both open and closed pores. Although one would not expect any single technique to provide a satisfactory description of a coal's structure, it is apparent that better techniques are necessary. Small angle scattering

could be improved by combining scattering and adsorption measurements. Also, the measurement of NMR parameters of various gas phase and adsorbed phase NMR active probes can provide pore structure information. We will investigate the dependence of the common NMR parameters such as chemical shifts and relaxation times of several different nuclei and compounds on the pore structure of model microporous solids, carbons, and coals. In particular, we will study the interaction between several small molecules (^{129}Xe, ^{3}He, $^{2}H_2$,$^{14}N_2$, $^{14}NH_3$, $^{15}N_2$,$^{13}CH_4$, $^{13}CO_2$) and the pore surfaces in coals.

32192 (DOE/PC/92521–T40) **Characterization of available coals from Illinois mines: [Quarterly] technical report, March 1, 1993–May 31, 1993.** Demir, I. (Illinois State Geological Survey, Champaign, IL (United States)); Harvey, R.D.; Ruch, R.R.; Chaven, C.; Damberger, H.H.; Steele, J.D.; Frankie, W.T. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019790. Source: OSTI; NTIS; GPO Dep.

The goal of this project is to characterize marketed coals from Illinois mines. The characterization parameters that are being determined include the concentration of all trace and minor elements that are of environmental concern, proximate and ultimate compositions, the pyrite size distribution and maceral association, preliminary froth flotation cleanability, slagging and fouling characteristics relevant to the coal's behavior in utility boilers, chlorine forms and distribution, and certain gasification and rheology parameters. During the third quarter, the trace element data base on Illinois coals was fully checked and edited. The determinations of the trace and minor element contents and proximate and ultimate compositions of the 34 project samples were largely completed. The pyritic S content, still high in some of the marketed samples, could be reduced further in the samples by advanced physical cleaning techniques. Results from the analysis of all 34 samples for Ba, Hg, Mn, and Zr indicate that these elements are primarily or partly associated with mineral matter and, therefore, their concentrations could also be reduced further in the product coals by advanced physical cleaning techniques. A sequential extraction of Cl from two of the samples revealed that regardless of the initial chlorine concentration of the two coals, the total combined amount of chlorine extracted by water, ammonia, and sodium hydroxide is about the same.

32193 (DOE/PC/92521–T44) **Protocols for the selective cleavage of carbon-sulfur bonds in coal: [Quarterly] technical report, March 1, 1993–May 31, 1993.** Bausch, M. (Southern Illinois Univ., Carbondale, IL (United States)). Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019794. Source: OSTI; NTIS; GPO Dep.

Chemical reactions that result in carbon-sulfur bond cleavage are an essential aspect of any protocol designed to remove organic sulfur from coal. Planned in the second year of our project "Protocols for the Selective Cleavage of Carbon-Sulfur Bonds in Coal" are investigations of reactions in which organic sulfur-containing coal model compounds are subjected to different conditions of temperature, solvent mixtures and radiation. other investigations that will result in analyses of the likelihood of C-S bond cleavages resulting from various oxidative processes will also be undertaken. Summarized in this quarterly report are results of our investigations of the following topics: (a) desulfurization of coal model sulfones and sulfides; (b) photolytic desulfurization of coal; (c) differential scanning calorimetric experiments on photooxidized coal; and (d) discussions on C-S bond strengths in radical cations.

32194 (DOE/PC/92521–T45) **Mass spectral study of organic sulfur in the polymeric matrix of coal: [Quarterly] technical report, March 1, 1993–May 31, 1993.** Hanley, L. (Illinois Univ., Chicago, IL (United States). Dept. of Chemistry). Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019795. Source: OSTI; NTIS; GPO Dep.

This report reviews the seventh quarter progress of a two year project to examine the chemical environment of organic sulfur in the polymeric matrix of Illinois coal by laser desorption ion trap mass spectrometry. This project is attempting to develop new laser desorption-ionization schemes for coal which preserve the polymeric matrix. From work this quarter, we have concluded that ultraviolet matrix assisted laser desorption is not an appropriate method to volatilize high molecular weight material extracted from coal. However, we have found that direct 355 nm laser desorption of neat samples of pyridine extracts from Illinois No. 6 coal gives what appears to be intact molecular ions. Direct laser desorption of the extract using both IR and UV wavelengths produces a distribution of ions between 150 and 1500 amu, with a peak near 500 amu. Work is continuing into the final quarter of this project to obtain such spectra from separated coal macerals and from various other coals.

32195 (DOE/PC/92521–T46) **Analysis of organic sulfur and nitrogen in coal via tandem degradation methods: [Quarterly] technical report, March 1–May 31, 1993.** Kruge, M.A. (Southern Illinois Univ., Carbondale, IL (United States). Dept. of Geology); Palmer, S.R. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019796. Source: OSTI; NTIS; GPO Dep.

There is need for alternative methods for determining the nature of organic sulfur and nitrogen compounds in coal. In our research, we apply chemical and thermal degradation techniques to render coal amenable to standard gas chromatography characterization. Standard density gradient centrifugation successfully isolated vitrinite from the IBC101 coal, whereas the multi-step high resolution method was required to isolate liptinite and inertinite macerals, which are minority constituents. Analytical pyrolysis-gas chromatography, operating with either the sulfur selective flame photometric detector (py-GC-PFD) or a mass spectrometer (py-GC/MS), provides distinctive organosulfur "fingerprints" for all coal, asphaltene and maceral samples analyzed to date. PY-GC/MS permits ready differentiation of asphaltenes from low and high rank coals. Of the two pyrolysis techniques, py-GC-FPD is simpler and less expensive, and is the recommended method for situations in which sulfur content is the prime concern. Both py-GC methods are superior to oxidative degradation techniques in that they are permit direct, one-step micro-scale analysis, requiring only a minimum of sample preparation. Distinctive chromatographic profiles are also achieved using the methylated dichromate oxidation products of coals, asphaltenes and macerals, but the extensive wet chemical preparation required is a serious disadvantage. Reasonable matches for the expected masses of alkylthiophene carboxylic acid derivatives have been found in the direct probe, low voltage, high resolution mass spectral data set collected on the methylated dichromate oxidation products of the sulfur-rich Spanish lignite sample, providing an additional line of evidence confirming the presence of such compounds.

32196 (DOE/PC/92521–T47) **VHF EPR analysis of organic sulfur in coal: [Quarterly] technical report, March 1, 1993–May 31, 1993.** Clarkson, R.B. (Illinois Univ., Urbana, IL (United States)); Belford, R.L. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019797. Source: OSTI; NTIS; GPO Dep.

One important goal of this project is the development of methods to analyze the Very High Frequency Electron Paramagnetic Resonance (VHF EPR) spectra from Illinois coals in order to determine the concentration of organic sulfur in them. In this third Quarter, the axially symmetric model for the simulation of VHF EPR coal spectra was refined for routine quantitative percent sulfur determination. The computer modeling technique which we have developed makes use of a sophisticated multi-dimensional simplex strategy for optimization. The percent sulfur determined from VHF-EPR of sporinite, vitrinite, and two blends of these macerals (from Illinois Herrin No. 6) show excellent linear correlation with far less reliable, time consuming, and difficult techniques.

32197 (DOE/PC/92521–T60) **Production of carbon molecular sieves from Illinois coal: [Quarterly] technical report,**

March 1, 1993–May 31, 1993. Lizzio, A.A. (Illinois State Geological Survey, Champaign, IL (United States)); Rostam-Abadi, M. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019810. Source: OSTI; NTIS; GPO Dep.

Carbon molecular sieves (CMS) have become an increasingly important class of adsorbents for use in gas separation and recover processes. The overall objective of this project is to determine whether Illinois Basin coals are suitable feedstocks for the production of CMS and to evaluate the potential application of these products in commercial gas separation processes. In Phase I of this project, gram quantities of char were prepared from Illinois coal in a fixed-bed reactor under a wide range of pyrolysis and activation conditions. Chars having surface areas of 1500–2100 m^2/g were produced by chemical activation using potassium hydroxide (KOH) as the activant. These high surface area chars had more than twice the adsorption capacity of commercial molecular sieves. The kinetics of adsorption of various gases, e.g., N_2, O_2, CO_2, CH_4, CO and H_2, on these chars at 25°C was determined. Several chars showed good potential for efficient O_2/N_2, CO_2/CH_4 and CH_4/H_2 separation; both a high adsorption capacity and selectivity were achieved. The full potential of these materials in commercial gas separations has yet to be realized. In Phase II of this project, larger quantities of char are being prepared from Illinois coal in a batch fluidized-bed reactor and in a continuous rotary tube kiln.

0108 Waste Management

Refer also to citation(s) 32158, 32163, 32213, 32215, 32217, 32219, 32227, 32232, 32240, 32329, 32757, 32764, 32765, 33764, 33765

32198 (DOE/FTR–93014704-Vol.1-2) **Travel to Europe to meet selective catalytic reduction catalyst suppliers: Foreign trip report, August 24–September 1, 1991.** Baldwin, A.L. (US-DOE Pittsburgh Energy Technology Center, PA (United States)); Maxwell, J.D. USDOE Pittsburgh Energy Technology Center, PA (United States); Southern Co. Services, Inc., Birmingham, AL (United States). 13 Dec 1991. 684p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-90PC89652. Order Number DE93014704. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Arthur L. Baldwin, Project Manager, Office of Clean Coal Technology, United States Department of Energy, Pittsburgh Energy Technology Center and J.D. (Doug) Maxwell, Project Manager, Southern Company Services, Inc., visited the two European Selective Catalytic Reduction (SCR) catalyst suppliers, Haldor Topsoe A/S and Siemens AC. for the Clean Coal Technology Round II SCR Project. The multi-purpose visit (August 24–September 1) was to review technologies, visit catalyst manufacturing facilities and pilot and commercial SCR installations, and obtain input to support the detailed engineering effort. At the time of this visit, the engineering was 30 percent complete for the 8.7 MWe, 9 reactor facility, which is to be installed at Gulf Power Company's Plant Crist, located at Pensacola, Florida. Also, the SCR technology of Mitsubishi Heavy industries European SCR System Supplier, Simmering - Graz Pauker VA (SGP), was reviewed and commercial SGP SCR installations visited. Visits have been planned to the three US (Engelhard, Grace, and Norton) and the two Japanese (Hitachi Zosen and Nippon Shokubai K.K.) SCR suppliers to acquire input from their companies on the detailed design. This report summarizes the European SCR Catalyst Supplier visit.

32199 (DOE/MC/22118–3413) **Field study of disposed wastes from advanced coal processes: Quarterly technical progress report, January–March 1993.** Radian Corp., Austin, TX (United States). [1993]. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-86MC22118. Order Number DE93040361. Source: OSTI; NTIS; GPO Dep.

The Department of Energy/Morgantown Energy Technology Center (DOE/METC) has initiated research on the disposal of solid wastes from advanced coal processes. The objective of this research is to develop information to be used by private industry and government agencies for planning waste disposal practices associated with advanced coal processes. To accomplish this objective, DOE has contracted Radian Corporation and the North Dakota Energy & Environmental Research Center (EERC) to design, construct, and monitor a limited number of field disposal tests with advanced coal process wastes. These field tests will be monitored over a three year period with the emphasis on collecting data on the field disposal of these wastes. This report describes leach tests and groundwater monitoring.

32200 (DOE/PC/88858–T13) **[Surface study of absorbents for the removal of SO_x and NO_x]: Quarterly report, December 1, 1990–February 28, 1991.** Cooper, B.R.; Montano, P. West Virginia Univ., Morgantown, WV (United States). Dept. of Physics. [1991]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-88PC88858. Order Number DE93019376. Source: OSTI; NTIS; GPO Dep.

X-ray absorption spectra were measured on two CuO/Al_2O_3 samples with 5 and 7% Cu loadings, at RT to 300 C. Flue gas was from Kentucky #5 coal burned in a small combustor. Measurements were completed on single-crystal CuO, confirming that the single-crystal behavior has no significant implications for understanding the adsorption mechanism of SO_2 on CuO/Al_2O_3. Modeling effort confirmed the previous tentative conclusion that the most favorable circumstance is for the SO_2 molecule bridging a Cu and an Al atom with the molecule bent away from the surface. 5 figs., 3 tabs.

32201 (DOE/PC/91295–T7) **A novel, integrated treatment system for coal waste waters: Quarterly report, March 2, 1993–June 1, 1993.** Wang, H.Y.; Srinivasan, K.R. Michigan Univ., Ann Arbor, MI (United States). Dept. of Chemical Engineering. [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91295. Order Number DE93040627. Source: OSTI; NTIS; GPO Dep.

The aims of this study are to develop, characterize and optimize a novel treatment scheme that would be effective simultaneously against the toxic organics and the heavy metals present in coal conversion waste waters. In this report, the following findings have been reported and discussed. Hec-CBDA-PA, (HCPA), a modified hectorite containing a mixed bilayer of a cationic (CBDA) and a long chain carboxylic acid (palmitic acid, PA) type surfactants, has been shown to adsorb Cu (II) strongly at pH 6.0 and quantitatively desorb the Cu(II) ions at pH 3.0. The overall mass balance of the adsorption/desorption cycle was quantified and it was found to be between 95 and 107%. Thus, a reversible, batch-wise scheme for the removal and recovery of a cationic heavy metal has been demonstrated. Future plans include repeated operation of the adsorption/desorption cycle. Adsorption of Cr(VI) onto HCDT and MONT-DT at pH 4.5 in presence and in the absence of a potentially competing organic ligand, β-naphthoic acid (NA), shows a limited amount of inhibition of Cr(VI) adsorption by NA. Further, the limiting adsorption density of CR(VI) on the two adsorbents was found to be nearly the same (2.5 - 3.0 mmoles/g), and this value was considerably higher the surface concentration of DT (0.72 and 1.44 mmoles of DT/g adsorbent in the case of HCDT and MONT-DT respectively), which is the active component in the adsorption process. The excess adsorption is postulated to arise from the oxidation of surface organic carbon by CR(VI) and the precipitation of CR(III) as its hydroxide at pH 4.5. Adsorption of NA onto HCDT and MONT-DT as a function of pH in the 4.5 - 9.0 range shows that anion exchange and hydrophobic partitioning are the two dominant mechanisms of NA adsorption onto modified-clays.

32202 (DOE/PC/92521–T42) **Plasma-assisted cleanup of flue gas: [Quarterly] technical report, March 1, 1993–May 31, 1993.** Dhali, S.K. (Southern Illinois Univ., Carbondale, IL (United States). Dept. of Electrical Engineering). Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019792. Source: OSTI; NTIS; GPO Dep.

The objective of the proposed research is to design and implement a novel scheme for the combined removal of SO_2 and NO_x using a dielectric-barrier discharge in conjunction with UV irradiation. This investigation requires the design of a dielectric-barrier

reactor and testing the proposed scheme under different conditions. The testing of the uniformity of the discharge with UV irradiation has been very successful. The details are provide-din this report and has been submitted to the Applied Physics Letter. In this reporting period both experimental and simulation work were carried out on the removal of SO_2 and NO_x. With the improved reactor, we have achieved a removal of SO_2 up to 85%. The simulation studies indicate that complete removal of NO_x is possible at reduced electric fields (E/N) of above 100 Td.

32203 (DOE/PC/92521–T43) **Microbial stabilization of sulfur-laden sorbents: [Quarterly] technical report, March 1, 1993–May 31, 1993.** Miller, K.W. (Illinois State Univ., Normal, IL (United States)). Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019793. Source: OSTI; NTIS; GPO Dep.

Clean coal technologies that involve limestone for in situ sulfur capture generate lime/limestone products laden with sulfur at various oxidation states. If sulfur is completely stabilized as sulfate, the spent sorbent is ready for commercial utilization as gypsum. However, the presence of reduced sulfur species requires additional processing. Thermal oxidation of reduced sulfur frequently results in undesirable release of SO_2. Microbial oxidation might provide an inexpensive and effective alternative. Sorbents laden with reduced forms of sulfur such as sulfide or sulfite can serve as growth substrates for sulfur-oxidizing bacteria, which convert all sulfur to sulfate. The goals of this project are the following: (1) to optimize conditions for sulfate generation from sulfide, thiosulfate, and sulfite; (2) to test and optimize the effectiveness of microbial processing on spent sorbents from flue gas desulfurization, coal gasification, and fluidized bed combustion; (3) to search for hyperalkalinophilic thiobacilli, which would be effective up to pH 11. This quarter, temperature, nitrogen, and phosphate requirements for sulfate generation on thiosulfate were optimized with respect to two named strains and two promising isolates. Spent sorbents from three different power plants were tested for sulfite and thiosulfate contents, in preparation for bioprocessing.

32204 (DOE/PC/92535–T3) **Control of coal combustion SO_2 and NO_x emissions by in-boiler injection of CMA: Second quarterly project status report, 1 April 1993–30 June 1993.** Levendis, Y.A.; Wise, D.L. Northeastern Univ., Boston, MA (United States). [1993]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-92PC92535. Order Number DE93040620. Source: OSTI; NTIS; GPO Dep.

Objectives of the proposed research are two-fold: (A) To understand the mechanism and assess the effectiveness of sulfur capture by the chemical calcium magnesium acetate (CMA); and (B) To evaluate the NO_x reduction capabilities of CMA by pyrolyzing the organic constituents of the chemical (the acetate) and reducing NO to stable N_2. The optimum conditions and the location of CMA introduction in the furnace will be identified. Water solutions of CMA or dry powders of CMA will be injected into hot air or gases simulating the furnace exhaust (containing CO_2, SO_x NO_x H_2O, O_2 etc.) and the composition of gaseous and solid products of the reaction will be monitored. The processes of burning the organic acetate as well as the calcination, sintering and sulfation of the remaining solid will be studied. The effectiveness of "homemade" CMAs containing various amounts of calcium and magnesium will be investigated to explore the role of the two chemicals in the NO_x and mainly the SO_2 capture processes. CMA will be introduced in the matrix of coal particles by an ion exchange technique. Upon subsequent combustion, the SO_2-NO_x emissions will be monitored and compared to those from burning untreated coal. The composition and physical structure of the ash residues will also be examined.

0109 Environmental Aspects

Refer also to citation(s) 32135, 32136, 32137, 32140, 32215, 32217, 32248, 33002, 33778, 34702

32205 (DOE/FTR–93015994) **Travel to Poland to evaluate projects to reduce pollution from combustion equipment: Foreign trip report, January 19–26, 1992.** Gyorke, D. (USDOE Pittsburgh Energy Technology Center, PA (United States)); Blinn, M. USDOE Pittsburgh Energy Technology Center, PA (United States). 9 Mar 1992. 17p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93015994. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A DOE team including Douglas Gyorke (DOE/PETC; FTS 723-6173) and Morton Blinn (Burns and Roe Services Corporation, FTS 723-4716) visited Poland on January 19–26, 1992 to review the progress of the Biuro Rozwoju Krakows (BRK) to conduct the five pilot subprojects included in the Krakow Clean Fossil Fuels and Energy Efficiency Project. The project will address approximately 1,350 small boiler houses and 200,000 home heating stoves in Crack that have been identified as being significant sources of atmospheric pollution. The five pilot subprojects will consider various approaches to reduction of pollution from this combustion equipment or the district heating system in Crack. If subprojects demonstrate commercial viability relative to a free market in Poland, they could lead to the formation of various Polish/American joint ventures to supply equipment, fuels, or conservation measures to reduce gaseous and particulate emissions in the Crack area. The five designated pilot subprojects are: 1. District Heating 2. Replacement by Natural Gas 3. Electric Heating. Boiler Houses 5. House Stoves In addition, there are two other subprojects which play a supporting role and are identified as: 6. Public Relations/ Information 7. Project Management.

32206 (DOE/FTR–93016207) **Travel to Poland for Krakow Clean Fossil Fuels and Energy Efficiency Project: Foreign trip report, April 20–30, 1992.** Gyorke, D.F. (USDOE Pittsburgh Energy Technology Center, PA (United States)); Blinn, M.B. USDOE Pittsburgh Energy Technology Center, PA (United States). [1992]. 24p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93016207. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Douglas Gyorke (US DOE/PETC; (412) 892-6173) and Morton Blinn (Burns and Roe Services Corporation; (412) 892-4716) visited Krakow, Poland, on April 20–30, 1992. The purpose of this visit was to review progress and plan future efforts on the Krakow Clean Fossil Fuels and Energy Efficiency Project. Also participating in the visit were Peter Kemeny of Burns and Roe Company (April 28 and 29 only) and Thomas Butcher and Jerome LaMontagne of Brookhaven National Laboratory (BNL). Trip reports for these other participants will be filed separately from this report. The itinerary of this trip is given in Attachment A. On April 23, 1991, the US/Poland Bilateral Steering Committee (BSC) for the Project identified Biuro Rozwoju Krakows (BRK) as the prime contractor to organize and coordinate five pilot subprojects for the Project. Beginning September 20, 1991, BRK was under letter contract with BNL to initiate efforts on the project, and the final contract was signed on February 11, 1992 The Project addresses approximately 1,350 small boiler houses and 125,000 home heating stoves in Krakow that have been identified as being significant sources of atmospheric pollution, and the five subprojects concern various approaches to pollution reduction. If subprojects demonstrate commercial viability relative to a free market in Poland, they could lead to the formation of various Polish/American joint ventures to supply equipment or fuels to reduce gaseous and particulate emissions in the Krakow area.

32207 (DOE/FTR–93017470) **Krakow Clean Fossil Fuel and Energy Efficiency Project planning committee visit to Poland: Foreign trip report, April 8–15, 1991.** Gyorke, D. (USDOE Pittsburgh Energy Technology Center, PA (United States)); Blinn, M. USDOE Pittsburgh Energy Technology Center, PA (United States). 17 Jun 1991. 40p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93017470. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A DOE team including Douglas Gyorke (DOE/PETC; FTS 723-6173) and Morton Blinn (BRSC; FTS 723-4716) visited Poland on April 8–15, 1991, to conduct planning and evaluation activities regarding the Krakow Clean Fossil Fuel and Energy Efficiency Project. Previously, approximately 3,000 small boilers and 200,000 home heating stoves in Krakow had been identified as being significant sources of atmospheric pollution, and five pilot projects

involving this combustion equipment, or conservation activities affecting their use, had been accepted by the US/Polish Bilateral Steering Committee to demonstrate various approaches to pollution reduction. If the projects demonstrated commercial viability relative to a free market in Poland, they would lead to the formation of various Polish/American joint ventures to supply equipment, fuels, or conservation measures to reduce gaseous and particulate emissions in the Krakow area. In general, the team's efforts were successful. The Polish side agreed with program concepts identified in the March 20, 1991, letter by Dr. Howard Feibus to Mr. Jerzy Wortz, Director of Environmental Protection for the Krakow Province. Polish entities were identified to: (1) carry out the Polish side of the program; and (2) define various test and conservation programs that would provide inputs to both pilot programs and general pollution reduction in Krakow. The proposal will identify tasks, schedule, proposed project management interfaces and budget. After DOE review of the proposal, BRK anticipates a meeting in Krakow to finalize the program and to discuss details of the boiler testing program.

0110 Reserves, Geology, and Exploration

Refer also to citation(s) 32188, 32233

0120 Mining

Refer also to citation(s) 33973

32208 (DOE/FTR–93017318) **Travel to Poland for the 12th International Coal Preparation Congress: Foreign trip report, September 15–23, 1991.** Hucko, R. USDOE Pittsburgh Energy Technology Center, PA (United States). [1991]. 11p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93017318. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This travel report discusses meetings in Poland concerning coal mining and coal preparation in Poland.

32209 (DOE/RW/00214–T1) **The Geotechnical Board National Research Council: [Annual] activities report, March 1, 1991–June 30, 1992.** Smeallie, P.H. National Academy of Sciences - National Research Council, Washington, DC (United States). 11 Aug 1993. 150p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-90RW00214. Order Number DE93019090. Source: OSTI; NTIS; GPO Dep.

This report covers the activities of the Geotechnical Board and its two national committees, the US National Committee for Rock Mechanics (USNC/RM) and the US National Committee on Tunneling Technology (USNC/TT), for the period from March 1, 1991 to June 30, 1992. The report covers a 16-month period, through June of this year, to bring the reporting period in line with the National Research Council's (NRC) fiscal year. Subsequent reports will cover the 12-month period July 1–June 30, unless individual contracts require otherwise. A description of the Geotechnical Board and its committees within the context of the National Academy of Sciences/National Research Council, as well as lists of current members of the board and national committees can be found in Attachment A.

0130 Transport, Handling, and Storage

Refer also to citation(s) 33409

0140 Combustion

Refer also to citation(s) 32158, 32159, 32170, 32205, 32206, 32329, 33050

32210 (CONF-910442–2) **Combustion behavior of single coal-water slurry droplets, Part 1: Experimental techniques.** Levendis, Y.A.; Metghalchi, M.; Wise, D. Northeastern Univ., Boston, MA (United States). Dept. of Mechanical Engineering. [1991]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-89PC89776. From 16. international conference on coal and slurry technologies; Clearwater, FL (United States); 22-25 Apr 1991. Order Number DE93017256. Source: OSTI; NTIS; GPO Dep.

Techniques to produce single droplets of coal-water slurries have been developed in order to study the combustion behavior of the slurries. All stages of slurry combustion are of interest to the present study, however, emphasis will be given to the combustion of the solid agglomerate char which remains upon the termination of the water evaporation and the devolatilization periods. An experimental facility is under construction where combustion of coal-water slurries will be monitored in a variety of furnace temperatures and oxidizing atmospheres. The effect of the initial size of the slurry droplet and the solids loading (coal to water ratio) will be investigated. A drop tube, laminar flow furnace coupled to a near-infrared, ratio pyrometer win be used to monitor temperature-time histories of single particles from ignition to extinction. This paper describes the experimental built-up to this date and presents results obtained by numerical analysis that help understanding the convective and radiating environment in the furnace.

32211 (CONF-930413–2) **Combustion of single CWF droplets of either pulverized or micronized coal.** Levendis, Y.A.; Atal, A. Northeastern Univ., Boston, MA (United States). Dept. of Mechanical Engineering. [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-89PC89776. From 18. international technical conference on coal utilization, slurry technologies and fuel systems; Clearwater, FL (United States); 26-29 Apr 1993. Order Number DE93017257. Source: OSTI; NTIS; GPO Dep.

This paper reports on new experimental findings on the combustion behavior of coal-water fuels (CWF) consisting of either pulverized coal (average size ca. 40μm) or of micronized coal (averaae size ca. 4μm). The former CWF is considered as a fuel in, utility boilers to substitute petroleum. The latter is considered as a fuel in diesel engines, gas turbines, etc. There are differences in the physical and chemical properties of these fuels since the size of the coal particles differs by an order of magnitude, the resulting packing factor is unequal and the mineral content is different by an order of magnitude as well, since the micronized slurries are also beneficiated. This work concentrated on the combustion of the solid agglomerated particles that remain upon completion of water evaporation. Experiments were conducted in a bench scale high-temperature drop-tube furnace, electrically heated to gas temperatures of 1450 K. Single CWF agglomerates (200–500 μm, in diameter) were introduced in the furnace, and upon ignition their combustion behavior was monitored with a specially developed three wavelength (640, 810 and 998 nm) pyrometer. Results showed that the overall combustion behavior of Agglomerates of the same size from the two coal grinds was similar when burned under the same conditions.

32212 (DOE/FTR–93014689) **Travel to United Kingdom for conference on coal science: Foreign trip report, September 16–20, 1991.** Brown, F.R.; Bockrath, B.C.; Farcasiu, M.; Pollack, S.S.; Shaffer, F.D. USDOE Pittsburgh Energy Technology Center, PA (United States). 27 Nov 1991. 34p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93014689. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The Sixth International Conference on Coal Science (ICCS) was held in Newcastle upon Tyne, U.K., September 16–20, 1991. Four hundred fifty four delegates representing 27 countries attended the 257-paper conference. The 1991 ICCS provided unique opportunities for PETC scientists (1) to hear unpublished accounts of current and on-going coal research in all major countries, (2) to discuss current research privately with coal scientists within the international coal community, and (3) to increase foreign awareness of US technologies and associated products that are available for export. Major topics included liquefaction, combustion, and desulfurization.

32213 (DOE/FTR–93014690) **Travel to Poland to discuss Skawina Clean Coal Retrofit Project and Krakow Clean Fossil Fuel and Energy Efficiency Project: Foreign trip report, December 9–14, 1991.** Lacey, J.J. USDOE Pittsburgh Energy Technology Center, PA (United States). 18 Dec 1991. 6p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93014690. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of this trip was to discuss with the appropriate Polish officials the status of our present cooperative efforts. These are divided into Phase 1 - The Skawina Clean Coal Retrofit Project

(Purpose: To demonstrate a clean coal technology that can be replicated in other plants in Poland and eastern Europe); and the Phase 2 - The Krakow Clean Fossil Fuel and Energy Efficiency Project (Purpose: To assist with the cleanup of the low emissions sources of Krakow as a prototype for other cities in Poland and eastern Europe).

32214 (DOE/FTR–93014691) **Travel to Poland to review Krakow Clean Fossil Fuels and Energy Efficiency Project: Foreign trip report, October 14–25, 1991.** Gyorke, D. (USDOE Pittsburgh Energy Technology Center, PA (United States)); Blinn, M. USDOE Pittsburgh Energy Technology Center, PA (United States). 6 Dec 1991. 21p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93014691. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A DOE team visited Poland on October 14–25, 1991 to review the progress of the Buiro Rozwoju Krakowa (BRK) to conduct the five pilot subprojects included in the Krakow Clean Fossil Fuels and Energy Efficiency Project. The five designated pilot subprojects are: district heating, replacement by natural gas, electric heating, boiler houses, and house stoves.

32215 (DOE/FTR–93014807) **Travel to Poland to review the public relations program with the Polish firm selected to be responsible for this portion of the Krakow Clean Fossil Fuels and Energy Efficiency Project: Foreign trip report, March 2–6, 1992.** Blinn, M.B. (Burns and Roe Services Corp., Oradell, NJ (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). [1992]. 13p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93014807. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of this visit to Krakow, Poland was to review the public relations program with the Polish firm selected to be responsible for this portion of the Krakow Clean Fossil Fuels and Energy Efficiency Project. The Project addresses approximately 1,350 small boiler houses and 125,000 home heating stoves in Krakow that have been identified as being significant sources of atmospheric pollution.

32216 (DOE/FTR–93015194) **Travel to India to aid in design of their coal Fuel Evaluation Test Facility: Foreign trip report, January 23–February 7, 1992.** Harding, S. (Burns and Roe Services Corporation (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). 1 Apr 1992. 28p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93015194. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Between January 23 and February 7, the traveler was in India supporting the US Agency for International Development (USAID) Program. The main purpose of the visit was to help Bharat Heavy Electrical Ltd. (BHEL) complete the final design of their Fuel Evaluation Test Facility (FETF). All control and instrumentation drawings for the coal handling, primary air, secondary air, compressed air, Dowtherm, soft water, demineralized water, cooling probe, and flue gas recirculation systems were reviewed, updated, and finalized.

32217 (DOE/FTR–93017307) **Travel to Poland for equipment capability assessments in clean burning coal combustion facilities: Foreign trip report, October 13–20, 1990.** Henzel, D.S. (Burns and Roe Services Corp., Pittsburgh, PA (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). 15 Feb 1991. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89PC88400. Order Number DE93017307. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The Pittsburgh Energy Technology Center (PETC). Office of Project Management is acting as the technical lead for DOE's involvement in President Bush's offer of assistance to Poland to help clean up its air pollution, specifically in the Krakow area. This trip addressed the need to perform an equipment assessment scoping analysis to form the basis for development of the capability within Poland to manufacture or modify boilers, furnaces, etc., so that Polish combustion facilities can burn Polish coal cleanly.

32218 (DOE/FTR–93017323) **Travel to Austria to conduct ash and deposit formation testing on US and Australian coals at SECV 10E06 Btu/hr facility: Foreign trip report, May 13–24, 1991.** Helble, J.J.; Moore, J.W. USDOE Pittsburgh Energy Technology Center, PA (United States). 25 Jun 1991. 14p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93017323. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of this trip was to conduct ash and deposit formation testing on US and Australian coals at State Electricity Commission of Victoria (SECV); 10E06 Btu/hr facility, and to discuss ongoing collaborative efforts in alkali evolution and control. The traveler also visited the CSIRO Division of Coal Technology and discuss their recent results plans for testing ash formation mechanisms for two US coals.

32219 (DOE/FTR–93017471) **DOE/FE technical team visit to Chile under the protocol of intent to cooperate in the deployment of Clean Coal Technologies: Foreign trip report, October 1–5, 1990.** USDOE, Washington, DC (United States). 24 Aug 1990. 39p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93017471. Source: OSTI; NTIS (US Sales Only); GPO Dep.

On October 1–5, 1990, a US Department of Energy technical team traveled to Santiago, Concepcion, Lota, and Coronel, Chile, to initiate technical activities under the "Protocol for Cooperation in the Deployment of Clean Coal Technologies." The DOE team met with several Government and private sector organizations during the one-week period. All of the Chileans that the team met with displayed a strong and enthusiastic interest in the deployment of CLEAN COAL TECHNOLOGIES. Their technical interests and activities also demonstrated a high degree of potential for market opportunities for US firms.

32220 (DOE/FTR–93019284) **Engineering foundation conference: The impact of ash deposition on coal fired plants: Foreign trip report, June 15–27, 1993.** Senior, C.L.; Wilemski, G. USDOE Pittsburgh Energy Technology Center, PA (United States). 17 Aug 1993. 17p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93019284. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Dr. Constance L. Senior (PSI Technology, 508/689-0003) visited Solihull, Birmingham, United Kingdom, on June 15–28, 1993; Dr. Gerald Wilemski (PSI Technology, 508/689-0003) visited Solihull, Birmingham, United Kingdom, on June 20–27, 1993. The purpose of this visit was to attend the Engineering Foundation Conference, "The Impact of Ash Deposition on Coal Fired Plants." The list of participants for this conference is given in Attachment A. Dr. Senior presented a paper, entitled "Ash Corrosion of Ceramic Materials for Advanced Coal-Fired Power Generation Cycles," in relation to the Pittsburgh Energy Technology Center's Combustion 2000 Program. Dr. Wilemski presented two papers related to the Pittsburgh Energy Technology Center's Fundamental Study of Ash Formation and Deposition Program. The first of these, entitled "Prediction of Ash Formation in Pulverized Coal Combustion with Mineral Distribution and Char Fragmentation Models," was co-authored by Dr. Srivats Srinivasachar of PSI Technology Co. The second paper, entitled "The Effect of Combustion Stoichiometry on Ash Formation," was authored by Dr. J.J. Helble, Dr. S. Srinivasachar and Dr. S.G. Kang, all of PSI Technology Co., none of whom were able to attend the meeting.

32221 (DOE/MC/10637–3365) **Determinations of ash formation and deposition mechanisms at Minnesota Power Clay Boswell Station.** Hurley, J.; Katrinak, K. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. Jul 1992. 83p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-86MC10637. Order Number DE93000282. Source: OSTI; NTIS; GPO Dep.

The University of North Dakota Energy and Environmental Research Center (EERC) conducted a two-part investigation of known and suspected ash-related problems that occur when a Montana subbituminous coal is burned in Unit 4 of the Clay Boswell Steam Electric Station near Cohasset, Minnesota. The research was performed in cooperation with Minnesota Power and a coal company. The target coal was termed "Coal A" to maintain confidentiality. A second Montana subbituminous coal, "Coal B," was used for comparison purposes. The first part of the work was designed to determine whether firing Coal A created deposition or corrosion problems in the convective pass of the boiler. There were three

areas of interest: corrosion of steam tubes in the reheater, downstream and cross-pendent deposits in the primary superheater and economizer, and hard deposits at the top of the secondary superheater. The goal of the second part of the investigation was to determine why the opacity of plant emissions were higher when burning 100% Coal A as compared to a 70/30 blend of Coal A and Coal B. Once the causes of the higher opacity were identified, a strategy for reducing the emissions was to be proposed.

32222 (DOE/MC/23295–3368) **Atmospheric fluidized bed combustion advanced system concepts applicable to small industrial and commercial markets: Topical report, Level 2.** Ake, T.R.; Dixit, V.B.; Mongeon, R.K. Riley Stoker Corp., Worcester, MA (United States). Sep 1992. 226p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-87MC23295. Order Number DE93000285. Source: OSTI; NTIS; GPO Dep.

As part of an overall strategy to promote FBC coal combustion and to improve the marketability of the eastern coals, the US Department of Energy's Morgantown Energy Research Center awarded a three level contract to Riley Stoker Corporation to develop advanced Multi Solids Fluidized Bed (MSFB) boiler designs. The first level of this contract targeted the small package boiler (10,000–50,000 lb/hr steam) and industrial size boiler (75,000–150,000 lb/hr steam) markets. Two representative sizes, 30,000 lb/hr and 110,000 lb/hr of steam, were selected for the two categories for a detailed technical and economic evaluation. Technically, both the designs showed promise, however, the advanced industrial design was favored on economic considerations. It was thus selected for further study in the second level of the contract. Results of this Level-2 effort, presented in this report, consisted of testing the design concept in Riley's 4.4 MBtu/hr pilot MSFB facility located at Riley Research Center in Worcester, Mass. The design and economics of the proof of concept facility developed in Level-1 of the contract were then revised in accordance with the findings of the pilot test program. A host site for commercial demonstration in Level-3 of the contract was also secured. It was determined that co-firing coal in combination with paper de-inking sludge will broaden the applicability of the design beyond conventional markets. International Paper (IP), the largest paper company in the world, is willing to participate in this part of the program. IP has offered its Hammermill operation at Lockhaven, Pa, site of a future paper de-inking plant, for the proof of concept installation. This plant will go in operation in 1994. It is recommended that METC proceed to the commercial demonstration of the design developed. The approach necessary to satisfy the needs of the customer while meeting the objectives of this program is presented along with a recommended plan of action.

32223 (DOE/MC/24132–3416) **TIDD PFBC Demonstration Project: First quarterly technical progress report, CY 1993.** American Electric Power Service Corp., Columbus, OH (United States). Apr 1993. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-87MC24132. Order Number DE93040355. Source: OSTI; NTIS; GPO Dep.

This is the 24th Technical Progress Report submitted in connection with the cooperative agreement between the DOE and the Ohio Power Company for the Tidd Pressurized Fluidized Bed Combustion (PFBC) Demonstration Plant. This report covers the period from January 1, 1993 to March 31, 1993. The following activities are reported: The unit was operated for a total of 331 hours (including gas turbine air prewarming). There were three gas turbine starts, five bed preheater starts, and two operating periods with coal fire. The peak gross output of 61 MWH was achieved for the period of 2200 to 2300 hours on January 20, 1993. The longest coal fire was 273 hours beginning at 0605 hours on January 20, 1993; total gross generation was 13,453 MWH, and coal consumption was 6,481 tons; The sorbent fines injection system was installed and is ready for use; A totally new secondary ash removal system was designed; New sparge ducts are being fabricated to replace the existing ducts; The plant was found to be in compliance with applicable Ohio regulation after an EPA inspection; and The unit has been out of service since early February due to the failure of the gas turbine. Replacement parts are being fabricated.

32224 (DOE/MC/25049–3372) **Scale models of circulating fluidized bed combustors: Simplification of the scaling laws and the scaling of convective heat transfer: Final report.** Glicksman, L.; Hyre, M.; Woloshun, K. Massachusetts Inst. of Tech., Cambridge, MA (United States). Mar 1993. 383p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-88MC25049. Order Number DE93000292. Source: OSTI; NTIS; GPO Dep.

A new set of simplified scaling laws has been proposed. When the gas to particle drag can be represented by the Ergun equation or similar expression, the new simplified scaling laws hold exactly in both the viscous dominated and gas inertial dominated limits. When the gas to particle drag is represented by drag on an isolated particle, the simplified scaling law also gives the correct limiting conditions for both viscous and interial limits. For intermediate conditions the gas to particle drag is also well approximated in models using the simplified scaling law. Tests of newly developed simplified scaling laws and the viscous limit scaling laws proposed previously were conducted using several different beds and particle types running over particle Reynolds numbers between 2.5 and 50. Experimental results demonstrate that the solid to gas density must be closely matched for a scale model to properly simulate a combustor or chemical reactor outside the viscous limit. Within the viscous limit, the density ratio must also be matched to correctly model a circulating bed near the slugging limit. The simplified set of scaling parameters which includes U_o/U_{mf}, Froude number, solid-to-gas density ratio, sphericity, and particle size distribution should be valid for both small and large particle Reynolds numbers. The simplified set allowed the Studsvik 2.5 MW atmospheric combustor to be closely modeled by a cold bed with linear dimensions 1/16 that of the combustor. Larger scale factors may also be valid. The simplified scaling laws should also apply to pressurized fluidized beds. The simplified scaling laws were also used for an initial evaluation of convective heat transfer similarity. Experimental results show good agreement in Nusselt numbers between properly scaled beds.

32225 (DOE/MC/29264–3398) **Scaling of pressurized fluidized beds: First quarterly progress report, October 1, 1992–January 15, 1993.** Glicksman, L.; Farrell, P. Massachusetts Inst. of Tech., Cambridge, MA (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-92MC29264. Order Number DE93040021. Source: OSTI; NTIS; GPO Dep.

Some preliminary work has been done to develop potential cold scale model designs to simulate the bed hydrodynamics of the American Electric Power Tidd pressurized bubbling fluidized bed combustor. The first design is based on the full set of scaling parameters presented in Equation (1), the second design was developed using the simplified set of scaling parameters given in Equation (2). The first design is roughly a 1:1 representation of a section of the core of the Tidd bed combustor. The additional flexibility provided by the simplified set of scaling parameters is particularly useful for developing experimental models of pressurized fluidized bed combustors where the full set of scaling relationships does not provide any reduction in the size of the models. Both the full and the simplified set of scaling relationships have been verified for applications to circulating fluidized bed combustors operating at atmospheric pressure. Currently there is a interest in fluidized bed combustors which operate at elevated pressures (~12 atm) for combined-cycle applications. One of the primary goals of this stud r is to verify both the till set and the simplified set of scaling relationships for applications to pressurized bubbling fluidized bed combustors.

32226 (DOE/METC–93/4113) **Phased-array ultrasonic surface contour mapping system: Technical note.** Fasching, G.E.; Loudin, W.J.; Paton, D.E.; Smith, N.S. Jr. USDOE Morgantown Energy Technology Center, WV (United States). Nov 1992. 68p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93000263. Source: OSTI; NTIS; GPO Dep.

The development of reliable mechanistic models for prediction of conventional and fluidized-bed combustor and gasifier operation and solids flow behavior in silos or other solids handling and storage components requires knowledge of the contained solids flow characteristics. This knowledge is gained from dynamic experimental measurements of bed top surface contours in addition to

measurements of bulk bed properties. The surface contour mapping system (SCMS) provides a means of generating surface contour maps in real time with a unique, automatically focused, density-compensated, digital phased-array scanning, ultrasonic-range measurement system. The system is designed to operate in environments having gas temperatures up to 1,600 °F and pressures to 1,000 psig. Computer simulation of several SCMS candidates and acoustic carrier modulation techniques indicates that a surface measurement resolution of ±2 inches over a range of 5 to 20 feet distance between the transmit/receive (T/R) transducers and the bed surface can be expected. The simulation of a particular design, a 9-T/R, 25-pixel bed surface, in which the level of each pixel was randomly set between 5 and 7 feet below the plane of the T/R transducers, then measured using two different modulation techniques, produced excellent results. The simulation of this surface contour mapping system determined the value of the level of each of the 25 pixels to within ±1 inch for over 95 percent of more than 100 test cases for one of the modulation techniques, and for over 99 percent of about 100 test cases for a second modulation technique. A hardware implementation of the design simulated but using only a two-T/R, three-pixel SCMS produced results very closely approximating those obtained during the simulation.

32227 (DOE/PC/79796–T33) **Enhancing the use of coals by gas reburning-sorbent injection: Quarterly report No. 23, April 1–June 30, 1993.** Energy and Environmental Research Corp., Irvine, CA (United States). 15 Jul 1993. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-87PC79796. Order Number DE93040711. Source: OSTI; NTIS; GPO Dep.

The objective of this project is to evaluate and demonstrate a cost effective emission control technology for acid rain precursors, oxides of nitrogen (NO_x and sulfur (SO_x), on two coal fired utility boilers in Illinois. The units selected are representative of pre-NSPS design practices: tangential and cyclone fired. Work on a third unit, wall fired, has been stopped because of funding limitations. Specific objectives are to demonstrate reductions of 60 percent in NO_x and 50 percent in SO_x emissions, by a combination of two developed technologies, gas reburning (GR) and sorbent injection (SI). With GR, about 80–85 percent of the coal fuel is fired in the primary combustion zone. The balance of the fuel is added downstream as natural gas to create a slightly fuel rich environment in which NO_x is converted to N_2. The combustion process is completed by overfire air addition. SO_x emissions are reduced by injecting dry sorbents (usually calcium based) into the upper furnace. This project is conducted in three phases at each site: (1) Design and Permitting, (2) Construction and Startup, and (3) Operation, Data Collection, Reporting and Disposition. In phase AIII at Hennepin - Testing, Data Collection, Reporting and Disposition - Gas Reburning runs were made that indicate as high as 77% reduction in NO_x emission using about 18% gas. Gas Reburning - Sorbent Injection test results indicated as high as 62% reduction in $S0_2$. A year of long term testing was completed in October, 1992.

32228 (DOE/PC/79916–3) **Determination of local radiative properties in coal-fired flames: Technical progress report, September 15, 1987–September 15, 1988.** Menguec, M.P.; Agarwal, B.; Bush, M.; Dsa, D.; Subramaniam, S. Kentucky Univ., Lexington, KY (United States). Dept. of Mechanical Engineering. [1988]. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-87PC79916. Order Number DE93019445. Source: OSTI; NTIS; GPO Dep.

Recently, an extensive, in-depth review of the modeling of radiation heat transfer in combustion chambers has been prepared (Viskanta and Menguc, 1987); therefore, there is no need to repeat that material here. It is already known that the most important missing link in the prediction of radiation heat transfer in combustion systems is the lack of detailed information about the optical and physical properties of combustion products (Viskanta and Menguc, 1987). The purpose of this research is to determine the radiative properties of coal particles. Considering the uncertainty in the fundamental optical and physical properties of coal particles, such as complex index of refraction, size, size distribution, and shape, it is difficult to predict the radiative properties of particles using available analytical methods, such as Lorenz-Mie theory. For a better understanding of radiation and radiation/combustion or radiation/turbulence interactions, it is preferable to determine the radiative properties in situ.

32229 (DOE/PC/89653–T7) **Innovative Clean Coal Technology (ICCT): 180 MW demonstration of advanced tangentially-fired combustion techniques for the reduction of nitrogen oxide (NO_x) emissions from coal-fired boilers: Fourth quarterly technical progress report, [October–December, 1992].** Southern Co. Services, Inc., Birmingham, AL (United States). [1992]. 175p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-90PC89653. Contract C-91-000028. Order Number DE93018900. Source: OSTI; NTIS; GPO Dep.

This quarterly report discusses the technical progress of a U. S. Department of Energy (DOE) Innovative Clean Coal Technology (ICCT) Project demonstrating advanced tangentially-fired combustion techniques for the reduction of nitrogen oxide (NOx) emissions from a coal-fired boiler. The project is being conducted at Gulf Power Company's Plant Lansing Smith Unit 2 located near Panama City, Florida. The primary objective of this demonstration is to determine the long-term effects of commercially available tangentially-fired low NOx combustion technologies on NOx emissions and boiler performance. A target of achieving fifty percent NOx reduction using combustion modifications has been established for the project. The stepwise approach that is being used to evaluate the NOx control technologies requires three plant outages to successively install the test instrumentation and the different levels of the low NOx concentric firing system (LNCFS). Following each outage, a series of four groups of tests are performed. These are (1) diagnostic, (2) performance, (3) long-term, and (4) verification. These tests are used to quantify the NOx reductions of each technology and evaluate the effects of those reductions on other combustion parameters such as particulate characteristics and boiler efficiency. During this quarter, tests of the LNCFS Level III system were conducted to determine the effect that fuel fineness has on NOx emissions and unburned carbon levels. Results showed that changing the fineness of the fuel has almost no effect on NOx emissions; however, unburned carbon levels can be reduced significantly by increasing fuel fineness.

32230 (DOE/PC/89778–T11) **Molten iron oxysulfide as a superior sulfur sorbent: Technical progress report, December 1, 1991–February 29, 1992.** Hepworth, M.T. Minnesota Univ., St. Paul, MN (United States). Inst. of Technology. 28 Feb 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-89PC89778. Order Number DE93019454. Source: OSTI; NTIS; GPO Dep.

Slagging combustors with injected lime or limestone are being considered as replacements for conventional coal burners. They have advantages in that they can be staged to reduce NO_x and SO_x emissions. Iron oxide, as an alternative to lime or limestone may be effective not only as a desulfurizing agent, but under the right conditions of oxygen potential and after combination with sulfur, the reaction products of coal gases with iron oxide can act as a flux to produce a fluid phase. The thermodynamic conditions for optimum removal of sulfur from the first stage of a coal combustor are being determined by experiment and by use of existing data. Analysis of the phase equilibria indicates that optimum conditions for deployment of the reducing stage of a multi-stage, burner operating with iron injection are close to the boundary of the liquid iron oxysulfide phase with iron-saturation. Two prior investigations differ with respect to the location of this phase boundary at temperatures over 1400°C: with reference 1, showing the phase boundary nearer the iron-rich corner than reference 2 which gives the boundary further into the liquid region. In this quarter experimental studies were conducted on equilibrium compositions which are the most effective in achieving desulfurization. These conditions were studied by thermogravimetric analysis (TGA). They serve to check the data reported by the two above-reference investigations for their experimental conditions of 1200°C, and also to check extend the data given in the literature to a temperature of 1300°C. The model used for this interpolation was reported upon in the prior quarterly report (9/1/91-11/30/92 Appendix A).

32231 (DOE/PC/89778–T13) **Molten iron oxysulfide as a superior sulfur sorbent: Technical progress report, June 1–August 31, 1992.** Hepworth, M.T. Minnesota Univ., St. Paul, MN (United States). Inst. of Technology. 1992. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-89PC89778. Order Number DE93019456. Source: OSTI; NTIS; GPO Dep.

Slagging combustors with injected lime or limestone are being considered as replacements for conventional coal burners. They have advantages in that they can be staged to reduce NO_x and SO_x emissions. Iron oxide, as an alternative to lime or limestone may be effective not only as a desulfurizing agent, but under the right conditions of oxygen potential and after combination with sulfur, the reaction products of coal gases with iron oxide can act as a flux to produce a fluid phase. The thermodynamic conditions for optimum removal of sulfur from the first stage of a coal combustor are being determined by experiment and by use of existing data. Analysis of the phase equilibria indicates that optimum conditions for deployment of the reducing stage of a multi-stage burner operating with iron injection are close to the boundary of the liquid iron oxysulfide phase with iron-saturation. In this quarter, three sets of experiments are being conducted: Equilibration at 1400°C between gas atmospheres containing oxygen and sulfur at controlled chemical potentials over oxysulfide melts to determine activity/composition relationships for the ternary isotherm in the Fe-O-S system, Kinetics of reactions on milligram-scale between magnetite in a thermogravimetric device in simulated coal/gas atmospheres which are optimum for desulfurization, and Studies on a 3 million btu per hour burner located at a local utility plant (Northern States Power, High-Bridge Plant in Saint Paul, MN) in which magnetite is injected into simulated coal gas atmospheres (produced by combustion of acetylene [C_2H_2]) under reducing conditions.

32232 (DOE/PC/89804–5) **Integrated emissions control system for residential CWS furnace: Final report, September 20, 1989–March 20, 1993.** Breault, R.W.; McLarnon, C. TECOGEN, Inc., Waltham, MA (United States). Mar 1993. 143p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89PC89804. (TR–4484-009-93). Order Number DE93018714. Source: OSTI; NTIS; GPO Dep.

One of the major obstacles to the successful development and commercialization of a coal-fired residential furnace is the need for a reliable, cost-effective emission control system. Tecogen is developing a novel, integrated control system to control NO_xSO_2, and particulate emissions. At the heart of this system is a unique emissions control reactor for the control of SO_2. This reactor provides high sorbent particle residence time within the reactor while doing so in a very compact geometry. Final cleanup of any fine particulates exiting the reactor including respirable-sized particulates, is completed with the use of high efficiency bag filters. Under a previous contract with PETC (Contract No. DE-AC22-87PC79650), Tecogen developed a residential-scale Coal Water Slurry (CWS) combustor to control NO_xemission. This combustor makes use of centrifugal forces, set up by a predominantly tangential flow field, to separate and confine larger unburned coal particles in the furnace upper chamber. Various partitions are used to retard the axial, downward flow of these particles, and thus maximize their residence time in the hottest section of the combustor. By operating this combustor under staged conditions, the local stoichiometry in the primary zone can be controlled in such a manner as to minimize NO_x emission.

32233 (DOE/PC/90258–T13) **Characterization and supply of coal-based fuels: Quarterly report, August 1, 1989–October 31, 1989.** Energy International, Inc., Pittsburgh, PA (United States). Dec 1989. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-86PC90258. Order Number DE93019448. Source: OSTI; NTIS; GPO Dep.

Under the Department of Energy's Combustor Technology Program, combustor contractors are developing combustor systems for use in residential, commercial, light industrial and industrial retrofit markets. Well-characterized coal based fuels possessing appropriate specifications are required by the contractors for their developmental test programs. Fuels may be dry pulverized or micronized coal or coal-water fuels. In support of these equipment development efforts, Energy International is providing such fuels. A complete list of all of the delivered fuels,the quantities and users are provided in the Appendix. Their fuel needs ranged from small sample quantities (e.g. 5 to 500 lbs.) up to 15 tons per delivery; by now most no longer need fuel. During the twelfth quarter of this contract (August 1, 1989 through October 31, 1989) the primary activities were involved with: (1) Continuation of the procurement, preparation and delivery of coal-based fuels for the combustor contractors. (2) Continuation of the interaction with combustor contractors in order to update their fuel specifications, fuel requirements and delivery schedules. (3) Continuation of the quality control activities to insure that fuel specifications are being met and to determine the cause of any problem which might occur. (4) Issuance of a request-for-bid (Procurement #MN-01-2003) for deep cleaning of Upper Elkhorn #3 coal to below 2% ash level, and subsequent award of purchase orders to five bidders. (5) Delivery to two separate PETC contractors coal-water slurry and dry, ground coal fuels. (5) Delivery of feed coals to three EI subcontractors who will deep-clean coal (Procurement Package #MN-01-2003).

32234 (DOE/PC/90547–T11) **Evaluation of gas-reburning and low NO_x burners on a wall fired boiler: Technical progress report No. 11, April 1–June 30, 1993.** Energy and Environmental Research Corp., Irvine, CA (United States). 15 Jul 1993. 16p. Sponsored by USDOE, Washington, DC (United States); Electric Power Research Inst., Palo Alto, CA (United States). DOE Contract FC22-91PC90547. Order Number DE93040712. Source: OSTI; NTIS; GPO Dep.

Clean Coal Technology (CCT) implies the use of coal in an environmentally acceptable manner. Coal combustion results in the emission of oxides of nitrogen (NO_x), which are precursors of both acid rain and ozone formation. The primary objective of this project is to evaluate the use of Gas Reburning and Low NO_x Burners (GR-LNB) for NO_x emission control from a wall fired boiler. Low NO_x burners are designed to delay the mixing of the coal fuel with combustion air to minimize the NO_x, formation. Typically, one may obtain up to 50% reduction in NO_x emissions through the use of LNB. With GR, about 80–85 percent of the coal fuel is fired in the main combustion zone. The balance of the fuel is added downstream as natural gas to create a slightly fuel rich environment in which NO_x is converted to N_2. The combustion process is completed by over-fire air addition. SO_x emissions are reduced to the extent that natural gas replaces sulfur-containing coal. The level of NO_x reduction achievable with 15–20% natural gas is on the order of 50–60%. Thus the emission reduction target of the combination of these two developed technologies is about 70%. Progress is described.

32235 (DOE/PC/91292–T7) **Rheological properties essential for the atomization of coal water slurries (CWS): Quarterly progress report, March 15–June 15, 1993.** Ohene, F. (Grambling State Univ., LA (United States). Dept. of Chemistry). USDOE Pittsburgh Energy Technology Center, PA (United States). [1993]. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91292. Order Number DE93040612. Source: OSTI; NTIS; GPO Dep.

The overall objective of this project is to perform experiments to understand the effect of high shear and extensional properties on the atomization of coal-water slurries (CWS). In the atomization studies, the mean drop size of the CWS sprays will be determined at various air-to CWS. A correlation between the extensional and high shear properties, particle size distributions and the atomization will be made in order to determine the influence of these parameters on the atomization of CWS. A theoretical relationship between the sauter mean diameter, (SMD), the Air/Fuel ratio and the viscosity was derived during the previous quarter. The established relationship was modified to account for the high shear viscosity data.

32236 (DOE/PC/92521–T36) **Combustion properties of coal-char blends: NO_x emission characteristics: [Quarterly] technical report, March 1, 1993–May 31, 1993.** Rostam-Abadi, M. (Illinois State Geological Survey, Champaign, IL (United States)); Khan, L.; Khan, S.; Smoot, L.D.; Germane, G.J.; Eatough, C.N. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 11p. Sponsored by USDOE, Washington,

DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019786. Source: OSTI; NTIS; GPO Dep.

Tests under pulverized coal combustion conditions suggest that NO_x formed during release of volatile matter far exceed NO_x formed during combustion of the resulting char. This is attributed to char/NO_x interactions by both direct reduction of NO_x by carbon and char-catalyzed reduction by CO. This implies combustion of char not only produces substantially lower NO_x but the presence of char in the flame during initial stages of combustion may potentially provide catalytic activity for reduction of NO_x produced from volatile nitrogen. The goal of the project is to determine if the concept of NO_x reduction by char/NO_x interactions, while maintaining a high combustion efficiency by co-firing coal with char, is a technically feasible way to reduce NO_x, emissions. The project will provide important combustion data required to establish the feasibility of utilizing chars in industrial combustion applications and the advantages of burning coal-char blends in reducing NO_x and SO_2 emissions. During the reporting period, 19 runs were made with a continuous feed charring oven (CFCO) to produce 237 pounds of char(about 16%vm) required for preparing coal-char blends.

32237 (DOE/PC/92521–T37) **Coal combustion under conditions of blast furnace injection: [Quarterly] technical report, 1 March 1993–31 May 1993.** Crelling, J.C. (Southern Illinois Univ., Carbondale, IL (United States). Dept. of Geology); Case, E.R. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019787. Source: OSTI; NTIS; GPO Dep.

A potentially new use for Illinois coal is its use as a fuel injected into a blast furnace to produce molten iron as the first step in steel production. Because of its increasing cost and decreasing availability, metallurgical coke is now being replaced by coal injected at the tuyere area of the furnace where the blast air enters. The purpose of this study is to evaluate the combustion of coal during the blast furnace injection process and to delineate the optimum properties of the feed coal. The basic program is designed to determine the reactivity of both coal and its derived char under blast furnace conditions and to compare the results to similar properties of blast furnace coke. The results of the first two experiments in which coal char pyrolyzed in nitrogen at 1000°C in an EPR were reacted isothermally in air at 1000°C and 1200°C. The reactivity values of the same char in these two experiments were different by an order of magnitude. The char reactivity at 1000°C was 9.7×10^{-4} grams per minute while the reactivity. of the char at 1200°C was 1.6×10^{-3} grams per minute. These results suggest that the temperature of the blast air in the tuyere may be critical in achieving complete carbon burnout.

32238 (DOE/PC/92521–T50) **Geochemistry of FBC waste-coal slurry solid mixtures: [Quarterly] technical report, March 1–May 31, 1993.** Dreher, G.B. (Illinois State Geological Survey, Champaign, IL (United States)); Roy, W.R.; Steele, J.D.; Heidari, M. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019800. Source: OSTI; NTIS; GPO Dep.

Three tasks are being conducted in this research project, all related to understanding the chemistry and mineralogy of the co-disposal of fluidized bed combustion (FBC) wastes with coal slurry solid (CSS) from a coal preparation plant. During coal cleaning, pyrite, other heavy minerals, and rock materials are rejected from the coal and discharged in an aqueous slurry to a slurry pond. After dewatering and abandonment of the pond, the pyrite may oxidize and produce acid that may migrate into the underlying groundwater system. If an alkaline product, such as FBC waste, is mixed with the CSS, then the acid will be effectively neutralized as it is produced. In Task 1, soluble components and acid-base reaction products from mixtures of FBC waste and CSS are being extracted for up to 180 days in a series of aqueous batch experiments. The final two sets of extractions, 90- and 180-days, were completed. The extracts and solids from these experiments were submitted for analysis of cations, anions, and mineralogy. In Task 2, 10 L of extracts from three mixtures of FBC waste and CSS were prepared for use in experiments to determine the adsorption/desorption reactions that occur between components of the extracts and three commonly occurring Illinois soils.

32239 (DOE/PC/92521–T52) **Integrated methods for production of clean char and its combustion properties: [Quarterly] technical report, March 1, 1993–May 31, 1993.** DeBarr, J.A. (Illinois State Geological Survey, Champaign, IL (United States)); Rostam-Abadi, M.; Gullett, B.K.; Benson, S.A. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019802. Source: OSTI; NTIS; GPO Dep.

An integrated method consisting of physical coal cleaning, mild gasification (MG) and low temperature oxidation (LTO) is proposed to produce chars with SO_2 emissions at least 50% lower than those of their parent coals. MG and char desulfurization studies are conducted in both a batch fluidized-bed reactor (FBR) and in a continuous rotary tube kiln (RTK). Combustion properties and ash deposition behaviors of desulfurized chars are determined at the US EPA in a 14 kill pilotscale combustor and at UNDEERC in a drop tube furnace (DTF). This project is cost-shared with the US EPA and the US DOE through UNDEERC. During the first year of this two year project, six coals from the IBC sample program (IBC-101, 102, 104, 105, 106 and 109) were studied. Under non-optimized conditions in the FBR, desulfurized chars were made with SO_2 emissions 60–71% lower than the parent coals, depending on the coal. Chars prepared from four of the six coals had SO_2 emissions less than 2.5 lbs SO_2/MMBtu. Under optimum conditions, SO_2 emissions of one of the coals were reduced nearly 67%, from 4.60 to 1.49 lbs SO_2/MMBtu. MG reduced the chlorine content of one coal 93%.

32240 (DOE/PC/92521–T63) **Evaluation and utilization of Illinois FBC residues for construction materials: [Quarterly] technical report, March 1–May 31, 1993.** Ghafoori, N. (Southern Illinois Univ., Carbondale, IL (United States). Dept. of Civil Engineering and Mechanics); Sami, S. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019813. Source: OSTI; NTIS; GPO Dep.

The overall objective of this program is to investigate the extent to which fluidized bed combustion (FBC) by-products can be properly utilized as viable construction materials. This investigation focuses primarily on the properties of residues derived from fluidized combustion burning of Illinois high-sulfur coal. The research plan calls for evaluation of physics-chemical and engineering characteristics of the FBC-based cement and non-cement mixes. The results of this study will be used to compare the physical and mechanical properties of the FBC-based mixtures with those of conventional mixes. The suitability of using FBC residues as filler or binder aggregates for Portland cement-based mixtures and non-Portland cement mixes in the form of conventional and roller compacted materials will be evaluated. During this reporting period, laboratory specimens relevant to the final phase of this research program; engineering characteristics of the optimized FBC spent bed and fly ash concretes (Task I); and engineering properties of the optimized roller compacted non-cement FBC mixes (Task II); were fabricated. Tests to ascertain fresh characteristics, strength, and elastic properties are completed. 'Vests on long-term durability are ongoing.

32241 (ECN-RX–93-067) **Flame transformations and burner slagging in a 2.5 MW furnace firing pulverized coal: Part 1: Flame transformations.** Ten Brink, H.M. (Unit ECN Fossil Fuels, Netherlands Energy Research Foundation, Petten (Netherlands)); Vleeskens, J.M.; Smart, J.P.; Williamson, J. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Jun 1993. 22p. Order Number DE93524585. Source: OSTI; NTIS; Available from the library of the Netherlands Energy Research Foundation (ECN), P.O. Box 1, 1755 ZG Petten (Netherlands).

Submitted for the journal 'Fuel'.

An experimental program is described in which the mechanism of deposit formation in a semi-industrial furnace, firing pulverized coal, has been investigated. The objective of this trial was to relate the in-flame transformations of the coal minerals to the nature of

the slags formed on deposition probes designed to simulate a burner quarl and a superheater tube respectively. The experiments were performed in the 2.5 MW refractory lined IFRF Furnace no. 1, using a swirl stabilized pulverized coal burner. Firing a pyrite-rich coal, in-flame samples and slag deposits were extracted from the flame and furnace and subsequently analyzed. The collected particles were analyzed for pyrite and pyrite decomposition products, using electron probe microanalysis and X-ray diffraction. It was found that immediately after injection into the flame pyrite (FeS_2) decomposed into pyrrhotite (FeS) which was present as molten droplets. The pyrrhotite droplets oxidized to solid iron oxide (Fe_3O_4 and Fe_2O_3) particles in both the internal and external recirculation zones in the furnace, thus reaching the rear of the deposit probes in a solid form. Due to the complex flow pattern in the furnace the kinetics of the pyrite conversion steps could not be directly determined, but these were indirectly derived from a comparison with the coal devolatilization and char oxidation steps. It is concluded that the decomposition of pyrite proceeds as fast as the coal devolatilization step and that the oxidation of pyrrhotite to iron oxide is a s fast as the oxidation of the coal/char. 4 figs., 5 tabs., 18 refs.

32242 (ECN-RX–93-068) **Flame transformations and burner slagging in a 2.5 MW furnace firing pulverized coal: Part 2: Slagging.** Ten Brink, H.M. (Unit ECN Fossil Fuels, Netherlands Energy Research Foundation, Petten (Netherlands)); Vleeskens, J.M.; Smart, J.P.; Williamson, J. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Jun 1993. 20p. Order Number DE93524586. Source: OSTI; NTIS; Available from the library of the Netherlands Energy Research Foundation (ECN), P.O. Box 1, 1755 ZG Petten (Netherlands).

Submitted for the journal 'Fuel'.

Results are reported of a three-day slagging trial in a 2.5 MW semi-industrial scale furnace in which the near-burner conditions of a wall-fired boiler were simulated. A pyrite-rich coal was fired in the experiment. Slag deposit probes were placed near the burner-wall simulating the refractory burner quarl with surrounding wall tubing. It was found that the side of the probe facing the incoming fuel stream was covered with a molten deposit. The deposits on the probe were similar to those on the burner-quarl of the furnace and to deposits in the near-burner region of full-sized furnaces. Slag was formed on the refractory material of the deposit probes and not on the water-cooled tubes surrounding the refractory; this suggests that slagging in the near-burner region in real boilers may also be initiated on the refractory quarl rather than on the surrounding water wall. The ash deposits were analyzed in-depth with scanning electron microscopy combined with elemental mapping. The nature of the deposits was related to the changes that the minerals had undergone in the furnace flame prior to deposition. The following mechanism of deposit formation was deduced. Deposition of molten pyrrhotite, the first flame product of pyrite, together with silicates, resulted in a composition of the deposit of iron-silicate. This composition had a very low melting point. which explained the molten character of the slag. Alumina and silicon carbide were used in the quarl deposit probes to determine possible differences in slag adherence. Adherence of the deposit to the silicon carbide was indeed less than the bonding of the deposits to the alumina surface. The reverse side of the probe facing downstream was covered with a very loose powder of discrete iron oxide and silicate particles. This is consistent with the presence and deposition of full oxidized solid pyrite particles in the furnace at this position. 8 figs., 1 tab., 10 refs.

32243 (NEI-DK–1235) **Coal and combustion research: Action plans. Main report.** Jysk-Fynske Elsamarbejde (ELSAM), Fredericia (Denmark). Sep 1992. 45p. Order Number DE93516632. Source: OSTI; NTIS.

With regard to the Danish electricity company "ELSAM", the plan of action for future research within the area of coal and combustion technology is described. Fields of research cover ultra super critical, integrated gasification combined cycle, pressurised coal combustion, pressurized pulverized coal combustion and coal research - technology. It also includes water chemistry research. Internally, the plan of action aims to ensure coordination and increase the value of ELSAM-funded research. Externally, it is intended as a signal to potential cooperation partners, such as other power station organizations or research laboratories, of ELSAM's intentions and as an indication of research areas which ELSAM would consider funding. The budget for research during the period 1992-1995 is presented. In the case of each of the five main areas of research, an introduction or background to the field in question is generally followed by a description of the objectives, the scope, the time scale, cooperation partners and a list of sections of research within the area. This scheme is variated according to the subject in hand. Priorities for sub-fields of research are given. (AB)

32244 (OCDO–93017600) **Demonstration of an advanced circulation fludized bed coal combustor phase 1: Cold model study: Final report.** Govind, R. (Cincinnati Univ., OH (United States). Dept. of Chemical Engineering). Ohio Coal Development Office, Columbus, OH (United States); Cincinnati Univ., OH (United States). Dept. of Chemical Engineering. 20 Mar 1993. 170p. Sponsored by Ohio State Government, Columbus, OH (United States). Grant CDO/R(D)-86-55B. Source: OSTI; Ohio Coal Development Office, 77 S. High Street, P.O. Box 1001, Columbus, OH 43266-0001 (United States).

It was found that there was a strong dependence of the density profile on the secondary air injection location and that there was a pronounced solid separation from the conveying gas, due to the swirl motion. Furthermore, the swirl motion generated strong internal circulation patterns and higher slip velocities than in the case of nonswirl motion as in an ordinary circulating fluidized bed. Radial solids flux profiles were measured at different axial locations. The general radial profile in a swirling circulating fluidized bed indicated an increased downward flow of solids near the bed walls, and strong variations in radial profiles along the axial height. For swirl numbers less than 0.9, which is typical for swirling circulating fluidized beds, there is no significant increase in erosion due to swirl motion inside the bed. Pending further investigation of swirl motion with combustion, at least from our cold model studies, no disadvantages due to the introduction of swirl motion were discovered.

32245 **A pulverized coal fuel injector.** Rini, M.J.; Towle, D.P. To Dept. of Energy. 1991. USA patent application 7-744,752. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-86PC90275. Order Number DE93019334. Source: OSTI; NTIS; GPO Dep.

A pulverized coal fuel injector contains an acceleration section to improve the uniformity of a coal-air mixture to be burned. An integral splitter is provided which divides the coal-air mixture into a number separate streams or jets, and a center body directs the streams at a controlled angle into the primary zone of a burner. The injector provides for flame shaping and the control of NO/NO_2 formation.

32246 (SAND–93-8236) **Coal combustion science quarterly progress report, October–December 1992: Task 1, Coal char combustion [and] Task 2, Fate of mineral matter.** Hardesty, D.R. (ed.) (Sandia National Labs., Livermore, CA (United States)); Hurt, R.H.; Baxter, L.L. Sandia National Labs., Albuquerque, NM (United States); Sandia National Labs., Livermore, CA (United States). Jun 1993. 47p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DR00789. Order Number DE93017283. Source: OSTI; NTIS; GPO Dep.

In the Coal Combustion Laboratory (CCL) this quarter, controlled laboratory experiments were carried out to better understand the late stages of coal combustion and its relation to unburned carbon levels in fly ash. Optical in situ measurements were made during char combustion at high carbon conversions and the optical data were related to particle morphologies revealed by optical microscopy on samples extracted under the same conditions. Results of this work are reported in detail below. In the data presented below, we compare the fraction of alkali metal loss to that of the alkaline earth metals as a function of coal rank to draw conclusions about the mechanism of release for the latter. Figure 2.1 illustrates the fractional release of the major alkali and alkaline earth metals (Na, K, Ca, Mg) as a function of coal rank for a series of coals and for several coal blends. All data are derived from combustion experiments in Sandia's Multifuel Combustor (MFC) and represent the average of three to eight experiments under conditions where the mass loss on a dry, ash-free (daf) basis exceeds 95 %. There

are no missing data in the figure. The several coals with no indicated result exhibited no mass loss of the alkali or alkaline earth metals in our experiments. There is a clear rank dependence indicated by the data in Fig. 2.1, reflecting the mode of occurrence of the material in the coal.

0150 Economic, Industrial, and Business Aspects

Refer also to citation(s) 33039

32247 (DOE/EIA–0513(93)) **The changing structure of the US coal industry: An update, July 1993.** USDOE Energy Information Administration, Washington, DC (United States). Office of Coal, Nuclear, Electric and Alternate Fuels. 29 Jul 1993. 48p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93018402. Source: OSTI; NTIS; GPO; INIS; GPO Dep.

Section 205(a)(2) of the Department of Energy Organization Act of 1977 requires the Administrator of the Energy Information Administration (EIA) to carry out a central, comprehensive, and unified energy data and information program that will collect, evaluate, assemble, analyze, and disseminate data and information relevant to energy resources, reserves, production, demand, technology, and related economic and statistical information. The purpose of this report is to provide a comprehensive overview of changes in the structure of the US coal industry between 1976 and 1991. The structural elements examined include the number of mines, average mine size, the size distribution of mines, and the size distribution of coal firms. The report measures changes in the market shares of the largest coal producers at the national level and in various regions. The Central Appalachian low-sulfur coal market is given special attention, and the market for coal reserves is examined. A history of mergers in the coal industry is presented, and changes in the proportions of US coal output that are produced by various types of companies, including foreign-controlled firms, are described. Finally, the impact of post-1991 mergers on the structure of the industry is estimated. The legislation that created the EIA vested the organization with an element of statutory independence. The EIA does not take positions on policy questions. The EIA's responsibility is to provide timely, high-quality information and to perform objective, credible analyses in support of deliberations by both public and private decisionmakers. Accordingly, this report does not purport to represent the policy positions of the US Department of Energy or the Administration.

32248 (DOE/FTR–93014802) **Travel to France as a DOE representative to the Fifth US-European Coal Conference in regard to increased export of US coals to Europe: Foreign trip report, April 29–May 5, 1991.** Strakey, J.P. USDOE Pittsburgh Energy Technology Center, PA (United States). [1991]. 10p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93014802. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The traveler participated in the Fifth "US-European Coal Conference" sponsored by the National Coal Association (NCA) and its affiliate, the Coal Exporters Association (CEA), and accompany the small Clean Coal Technology Exhibit (the "Map Exhibit"), which was displayed at the conference. The conference generally highlighted a bright future for increased export of US coals to Europe in the next decade. Deputy Secretary Henson Moore presented the luncheon address and stressed a promising future for US coal production and use and emphasized the importance of Clean Coal technologies. Interest in the exhibit and DOE/FE publications was moderate. Suggestions are offered for future conferences where the exhibit is displayed.

0160 Health and Safety

32249 (DOE/PC/91284–6) **Nitration of polynuclear aromatic hydrocarbons in coal combustors and exhaust streams: Quarterly report, January 1, 1993–March 31, 1993.** Yu, L.; Dadamio, J.; Hildemann, L.; Niksa, S. Stanford Univ., CA (United States). Dept. of Civil Engineering. Jun 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91284. Order Number DE93019562. Source: OSTI; NTIS; GPO Dep.

Nitro-polynuclear aromatic hydrocarbons (nitro-PAH) are the predominant mutagens on respirable particles from coal-fired boilers. Since nitro-PAH are not primary products of coal devolatilization, their formation must involve secondary chemistry at elevates temperatures. However, it is not known where in the combustion or exhaust processes they form, which reaction species are involved, or how concentrations are influenced by operating conditions. Results from this study will help to relate the environmental impact of mutagenic emission to boiler firing strategies. The objectives of this three-year project are to (1) identify the conditions which promote the nitration of PAH during primary combustion, reburning, hot gas cleanup, and particulate removal; and (2) investigate the potential relationship between NO_x abatement and PAH nitration. A novel coal flow reactor burning actual coal products operates over the domains of heating rates, temperatures, fuel-equivalence ratios, and residence times in utility boilers. A fluidized bed will be built for studies of simulated hot gas cleanup at lower temperatures. Gas chromatography with chemiluminescence detection will measure the aggregate amount of nitro groups present to determine when nitro-PAH first appear, and how nitration is affected by the operating conditions. Tars from primary and secondary pyrolysis and oxidative pyrolysis will be fractionated into chain hydrocarbons, polynuclear aromatics, oxygenated species, and a basic fraction, so that their ring number distribution can be monitored with high performance liquid chromatography.

02 PETROLEUM

0202 Reserves, Geology, and Exploration

Refer also to citation(s) 32261, 32266

32250 (DOE/BC/14470–10) **Characterization of facies and permeability patterns in carbonate reservoirs based on outcrop analogs: Final report.** Kerans, C.; Lucia, F.J.; Senger, R.K.; Fogg, G.E.; Nance, H.S.; Hovorka, S.D. Texas Univ., Austin, TX (United States). Bureau of Economic Geology. Jul 1993. 160p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89BC14470. Order Number DE93000150. Source: OSTI; NTIS; GPO Dep.

The primary objective of this research is to develop methods for better describing the three-dimensional geometry of carbonate reservoir flow units as related to conventional or enhanced recovery of oil. San Andres and Grayburg reservoirs were selected for study because of the 13 Bbbl of remaining mobile oil and 17 Bbbl of residual oil in these reservoirs. The key data base is provided by detailed characterization of geologic facies and rock permeability in reservior-scale outcrops of the Permian San Andres Formation in the Guadalupe Mountains of New Mexico. Emphasis is placed on developing an outcrop analog for San Andres strata that can be used as (1) a guide to interpreting the regional and local geologic framework of the subsurface reservoirs (2) a data source illustrating the scales and patterns of variability of rock-fabric facies and petrophysical properties, particularly in lateral dimension, and on scales that cannot be studied during subsurface reservoir characterization. The research approach taken to achieve these objectives utilizes the integration of geologic description, geostatistical techniques, and reservoir flow simulation experiments. Results from this research show that the spatial distribution of facies relative to the waterflood direction can significantly affect how the reservoir produces. Bypassing of unswept oil occurs due to cross flow of injected water from high permeability zones into lower permeability zones were high permeability zones terminate. An area of unswept oil develops because of the slower advance of the water-injection front in the lower permeability zones. When the injection pattern is reversed, the cross-flow effect changes due to the different arrangements of rock-fabric flow units relative to the flow of injected water, and the sweep efficiency is significantly different. Flow across low-permeability mudstones occurs showing that these layers do not necessarily represent flow barriers.

32251 (DOE/BC/14956–1) **Identification and evaluation of fluvial-dominated deltaic (Class I oil) reservoirs in Oklahoma: Quarterly technical progress report, January 1, 1993–March 31, 1993.** Mankin, C.J. (Oklahoma Geological Survey, Norman, OK (United States)); Grasmick, M.K. Oklahoma Univ., Norman, OK

(United States). 4 Jun 1993. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-93BC14956. Order Number DE93019885. Source: OSTI; NTIS; GPO Dep.

The Oklahoma Geological Survey (OGS), the Geological Information Systems department, and the School of Petroleum and Geological Engineering at the University of Oklahoma have engaged in a program to identify and address Oklahoma's oil recovery opportunities in fluvial-dominated deltaic (FDD) reservoirs. This program includes the systematic and comprehensive collection and evaluation of information on all of Oklahoma's FDD reservoirs and the recovery technologies that have been (or could be) applied to those reservoirs with commercial success. This data collection and evaluation effort will be the foundation for an aggressive, multifaceted technology transfer program that is designed to support all of Oklahoma's oil industry, with particular emphasis on smaller companies and independent operators in their attempts to maximize the economic producibility of FDD reservoirs. Specifically, this project will identify all FDD oil reservoirs in the State; group those reservoirs into plays that have similar depositional and subsequent geologic histories; collect, organize and analyze all available data; conduct characterization and simulation studies on selected reservoirs in each play; and implement a technology transfer program targeted to the operators of FDD reservoirs to sustain the life expectancy of existing wells with the ultimate objective of increasing oil recovery.

32252 (IFE/KR/F–93/094) **Models of fluid flow and heat flow in compacting sedimentary basins.** Wangen, M. Institutt for Energiteknikk, Kjeller (Norway); Oslo Univ. (Norway). May 1993. 144p. Order Number DE93525283. Source: OSTI; NTIS.

The thesis consists of 3 papers. The first paper is about the effect continuous sedimention has on the excess pressure, compaction and temperature in a sedimentary basin. An answer is given in terms of two dimensionless numbers, which characterize the pressure equation and the temperature equation, respectively. The Gibson solution for excess pressure in a clay layer increasing linearily with time, is found to be a solution of the dimensionless pressure equation presented, when a special choice for permeability and porosity functions is made. The second paper presents a simple one-dimensional, one-lithological model of integrated hydrocarbon generation and migration. A saturation equation for a basin during a state of constant sedimentation is presented, where the basin height is transformed to the unit interval. Fractional flow theory is applied to avoid a pressure equation, and an analytical saturation solution is presented for the base of constant porosity and negligible capillary pressure. The solution applies outside the region where hydrocarbons are generated, and it is characterized by a dimensionless number. By means of this solution, it may be decided if and when hydrocarbons will reach the basin top. The third paper presents a finite element formulation for fluid flow and heat flow in compacting sedimentary basins, where the compaction is restricted to the vertical direction. The height of a sediment grain measured as compact rock (no pore space) from the basement, is chosen as the Lagrangian coordinate. Two equivalent formulations are given, one directly in the Lagrangian coordinates and another in the real coordinates, where the grid is obtained by mapping the Lagrangian grid to the real space. It is concluded that the formulation on the real space grid is to be preferred due to its simplicity. 70 refs., 59 figs., 9 tabs.

32253 (NEI-NO–346) **The effect of heterogeneity on fluid flow. Stochastic modeling of absolute and relative permeabilities in oil reservoirs.** Tjoelsen, C.B. Bergen Univ. (Norway). 1993. 142p. Order Number DE93525282. Source: OSTI; NTIS.

This thesis contains 6 papers. The first paper presents a two-stage stochastic model that caters for the geological heterogeneities resulting from different rock types and the inherent spatial variability of rock properties. An example from a highly heterogeneous North Sea reservoir, deposited in an upper shore-face environment, illustrates the application of the model. This model is extended in paper 2, to model both static and dynamic saturation dependent properties (relative permeabilities) simultaneously. Hence, the main objective is to derive relationships between the petrophysical properties. The paper 3 addresses the simultaneous stochastic modeling of spatial variations of both absolute and relative permeability, with special emphasis on the impact on oil recovery from spatially varying relative permeability curves. The main conclusion is that in the cases studied, the introduction of stochastic variation in the relative permeability curves has no significant effect on the shape of the production profiles. In paper 4 the model described in paper 3 was applied to four different depostional environments, with large variation in the petrophysical properties and the interrelationships between the variables. The purpose of paper 5 is to describe a technique to scale up absolute permeability from a fine to a coarser grid, and to study how well this technique actually performs. The last paper describes a technique for stochastic simulation of permeability on a geological description grid, which will honour the observed core-plug measurements. Two or more steps are necessary. The technique handles the transition from core-plug to reservoir description scale correctly and consistently, provided some model assumptions are fulfilled. 168 refs., 54 figs., 17 tabs.

32254 (NIPER–622) **Annotated bibliography of selected references on shoreline barrier island deposits with emphasis on Patrick Draw Field, Sweetwater County, Wyoming.** Rawn-Schatzinger, V.; Schatzinger, R.A. National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States). Jul 1993. 67p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-83FE60149. Order Number DE93000155. Source: OSTI; NTIS; GPO Dep.

This bibliography contains 290 annotated references on barrier island and associated depositional environments and reservoirs. It is not an exhaustive compilation of all references on the subject, but rather selected papers on barrier islands, and the depositional processes of formation. Papers that examine the morphology and internal architecture of barrier island deposits, exploration and development technologies are emphasized. Papers were selected that aid in understanding reservoir architecture and engineering technologies to help maximize recovery efficiency from barrier island oil reservoirs. Barrier islands from Wyoming, Montana and the Rocky Mountains basins are extensively covered.

0203 Drilling and Production

Refer also to citation(s) 32158, 32250, 32251, 32254, 32303, 32309, 32329

32255 (BNL–49351) **Application of multitracer technology to petroleum reservoir studies: Quarterly progress report, October 1–December 31, 1992.** Senum, G.I. Brookhaven National Lab., Upton, NY (United States). Jun 1993. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE93040033. Source: OSTI; NTIS; GPO Dep.

The objectives of this research program are to: (1) Improve the assessment of the character of petroleum reservoirs using tracer technology for the monitoring and improvement of EOR techniques, specifically, (a) to apply the presently available multitracer perfluorocarbon tracer (PFT) technology to the study of petroleum reservoirs in characterizing reservoir bulk subsurface flow transport and dispersion rates; and, (b) to demonstrate that PFTs with differing physical properties will interact with differing rates of adsorption and dispersion within such reservoirs, from which may be inferred difference in the character and/or extent of petroleum in those reservoirs. This is accomplished by participation in field experiments so as to fully demonstrate the perfluorocarbon tracer technology in its utility in this aspect. 2. Develop new tracers, compatible with the perfluorocarbon tracer technology, so as to interface these new tracers in a suite of tracers available for petroleum reservoir experiments. 3. Design and performance of a quantitative PFF experiment to demonstrate the potential of calculating a two-dimensional residual oil saturation map based on a multi-PFT tracer experiment in a reservoir. Technical progress is discussed for: (1) Ongoing demonstration experiments at the Naval Petroleum Reservoir in California; (2) development of new tracers; and (3) design of the 2D residual oil mapping experiment.

32256 (DOE/BC/14445–12) **Microbial enhanced oil recovery research: Final report, Annex 5.** Sharma, M.M.; Gerogiou, G.

Texas Univ., Austin, TX (United States). Dept. of Petroleum Engineering. Jul 1993. 131p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-89BC14445. Order Number DE93000151. Source: OSTI; NTIS; GPO Dep.

The objective of this project was to develop an engineering framework for the exploitation of microorganisms to enhance oil recovery. An order of magnitude analysis indicated that selective plugging and the production of biosurfactants are the two most likely mechanisms for the mobilization of oil in microbial enhanced oil recovery (MEOR). The latter, biosurfactant production, is easier to control within a reservoir environment and was investigated in some detail. An extensive literature survey indicated that the bacterium Bacillus licheniformis JF-2 produces a very effective surface active agent capable of increasing the capillary number to values sufficiently low for oil mobilization. In addition, earlier studies had shown that growth of this bacterium and biosurfactant production occur under conditions that are typically encountered in MEOR, namely temperatures up to 55°C, lack of oxygen and salinities of up to 10% w/v. The chemical structure of the surfactant, its interfacial properties and its production by fermentation were characterized in some detail. In parallel, a set of experiments as conducted to measure the transport of Bacillus licheniformis JF-2 in sandpacks. It was shown that the determining parameters for cell transport in porous media are: cell size and degree of coagulation, presence of dispersants, injection velocity and cell concentration. The mechanisms of bacteria retention within the pores of the reservoir were analyzed based on heuristic arguments. A mathematical simulator of MEOR was developed using conservation equations in which the mechanisms of bacteria retention and the growth kinetics of the cells were incorporated. The predictions of the model agreed reasonably well with experimental results.

32257 (DOE/BC/14600–51) **Kinetics of in situ combustion: SUPRI TR 91.** Mamora, D.D.; Ramey, H.J. Jr.; Brigham, W.E.; Castanier, L.M. Stanford Univ., CA (United States). Petroleum Research Inst. Jul 1993. 310p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90BC14600. (SUPRI-TR–91). Order Number DE93000152. Source: OSTI; NTIS; GPO Dep.

Oxidation kinetic experiments with various crude oil types show two reaction peaks at about 250°C (482°F) and 400°C (725°F). These experiments lead to the conclusion that the fuel during high temperature oxidation is an oxygenated hydrocarbon. A new oxidation reaction model has been developed which includes two partially-overlapping reactions: namely, low-temperature oxidation followed by high-temperature oxidation. For the fuel oxidation reaction, the new model includes the effects of sand grain size and the atomic hydrogen-carbon (H/C) and oxygen-carbon (O/C) ratios of the fuel. Results based on the new model are in good agreement with the experimental data. Methods have been developed to calculate the atomic H/C and O/C ratios. These methods consider the oxygen in the oxygenated fuel, and enable a direct comparison of the atomic H/C ratios obtained from kinetic and combustion tube experiments. The finding that the fuel in kinetic tube experiments is an oxygenated hydrocarbon indicates that oxidation reactions are different in kinetic and combustion tube experiments. A new experimental technique or method of analysis will be required to obtain kinetic parameters for oxidation reactions encountered in combustion tube experiments and field operations.

32258 (DOE/BC/14600–52) **Modification of chemical and physical factors in steamflood to increase heavy oil recovery: Annual report, October 1, 1991–September 30, 1992.** Yortsos, Y.C. University of Southern California, Los Angeles, CA (United States). Dept. of Chemical Engineering. Jul 1993. 206p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90BC14600. Order Number DE93000157. Source: OSTI; NTIS; GPO Dep.

This report covers work performed in the various physicochemical factors for the improvement of oil recovery efficiency. In this context, three general areas were studied: (i) The understanding of vapor-liquid flow in porous media, whether the flow is internal (boiling), external (steam injection) or countercurrent (as in vertical heat pipes); (ii) The effect of reservoir heterogeneity, particularly as it regards fractured systems; (iii) The flow properties of additives for the improvement of recovery efficiency, in particular the injection of caustic and foams. The studies completed under this contract involved ap three research tools, analysis, computation and experiments. We have focused on pore level modeling using pore networks and on flow visualization using Hele-Shaw cells. Experiments involving core samples were conducted for the chemical additives investigation. Finally, simulation at the pore scale, pore network scale and reservoir scale were also undertaken. Part of the work has been detailed in five DOE Technical Reports as shown at the end of this report.

32259 (DOE/BC/14600–53) **SUPRI heavy oil research program: Annual report, October 1, 1991–September 30, 1992.** Brigham, W.E.; Ramey, H.J. Jr.; Castanier, L.M. Stanford Univ., CA (United States). Petroleum Research Inst. Aug 1993. 113p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90BC14600. Order Number DE93000161. Source: OSTI; NTIS; GPO Dep.

The goal of the Stanford University Petroleum Research Institute is to conduct research directed toward increasing the recovery of heavy oils. Presently, SUPRI is working in five main directions: (1) flow properties studies to assess the influence of different reservoir conditions (temperature and pressure) on the absolute and relative permeability to oil and water and on capillary pressure; (2) in-situ combustion to evaluate the effect of different reservoir parameters on the in-situ combustion process and to study the kinetics of the reactions; (3) steam with additives to develop and understand the mechanisms of the process using commercially available surfactants for reduction of gravity override and channeling of steam; (4) formation evaluation to develop and improve techniques of formation evaluation such as tracer tests and pressure transient tests; and field support services to provide technical support for design and monitoring of DOE sponsored or industry initiated field projects.

32260 (DOE/BC/14650–13) **A novel approach to modeling unstable EOR displacements: Quarterly report, April 1993–June 1993.** Peters, E.J. Texas Univ., Austin, TX (United States). Dept. of Petroleum Engineering. [1993]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90BC14650. Order Number DE93040009. Source: OSTI; NTIS; GPO Dep.

This research is aimed at developing a methodology for predicting the performance of unstable displacements in heterogeneous reservoirs. A performance prediction approach that combines numerical modeling with laboratory imaging experiments is being developed. Flow visualization experiments are being performed on laboratory corefloods using X-ray Computed Tomography (CT) and other imaging technologies to map the in situ fluid saturations in time and space. A systematic procedure is being developed to replicate the experimental image data with high-resolution numerical models of the displacements. The well-tuned models will then be used to scale the results of the laboratory coreflood experiments to heterogeneous reservoirs in order to predict the performance of unstable displacements in such reservoirs. In this report, we examine the problem of hydrodynamic instability in miscible displacements. We present the mathematical model for unstable first-contact miscible displacements. The mathematical model is nondimensionalized to derive the dimensionless similarity scaling groups for unstable displacements. Although the mathematical model is not integrated in this report, the dimensionless form of the model reveals the similarity groups that control the displacement performance. CT images of two unstable, first-contact miscible displacements are presented to demonstrate the effects of some of the similarity groups on the displacement performance.

32261 (DOE/BC/14657–13) **Measuring and predicting reservoir heterogeneity in complex deposystems: [Quarterly] report, April–June 1993.** Donaldson, A.C.; Shumaker, R.; Heald, M.; Aminian, K.; Hohn, M.E. West Virginia Univ., Morgantown, WV (United States). [1993]. 41p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-90BC14657. Order Number DE93040012. Source: OSTI; NTIS; GPO Dep.

The main goal of this research project is to understand reservoir heterogeneity sufficiently to predict optimum drilling locations versus high-risk locations in a given field in order to recommend the most cost-effective infill-drilling programs.The proposed research is

designed to use a multidisciplinary approach to measure and map heterogeneity at various scales, and ultimately to develop tools and techniques to predict heterogeneity, both in existing fields and in undrilled areas. Two stratigraphic units have been chosen for this research. The Big Injun sandstone (Mississippian) in West Virginia, and the Rose Run Sandstone (Ordovician) in Ohio and Pennsylvania.

32262 (DOE/BC/14818–1(Vol.1)) **Oil and gas technology transfer activities and potential in eight major producing states: Volume 1.** Interstate Oil and Gas Compact Commission, Oklahoma City, OK (United States). Jul 1993. 160p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91BC14818. Order Number DE93000148. Source: OSTI; NTIS; GPO Dep.

In 1990, the Interstate Oil and Gas Compact Commission (the Compact) performed a study that identified the structure and deficiencies of the system by which oil and gas producers receive information about the potential of new technologies and communicate their problems and technology needs back to the research community. The conclusions of that work were that major integrated companies have significantly more and better sources of technology information than independent producers. The majors also have significantly better mechanisms for communicating problems to the research and development (R&D) community. As a consequence, the Compact recommended analyzing potential mechanisms to improve technology transfer channels for independents and to accelerate independents acceptance and use of existing and emerging technologies. Building on this work, the Compact, with a grant from the US Department Energy, has reviewed specific technology transfer organizations in each of eight major oil producing states to identify specific R&D and technology transfer organizations, characterize their existing activities, and identify potential future activities that could be performed to enhance technology transfer to oil and gas producers. The profiles were developed based on information received from organizations,follow-up interviews, site visit and conversations, and participation in their sponsored technology transfer activities. The results of this effort are reported in this volume. In addition, the Compact has also developed a framework for the development of evaluation methodologies to determine the effectiveness of technology transfer programs in performing their intended functions and in achieving desired impacts impacts in the producing community. The results of that work are provided in a separate volume.

32263 (DOE/BC/14818–2(Vol.2)) **A framework for evaluation of technology transfer programs: Volume 2.** Interstate Oil and Gas Compact Commission, Oklahoma City, OK (United States). Jul 1993. 84p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91BC14818. Order Number DE93000149. Source: OSTI; NTIS; GPO Dep.

The objective of this volume is to describe a framework with which DOE can develop a program specific methodology to evaluate it's technology transfer efforts. This approach could also be applied to an integrated private sector technology transfer organization. Several benefits will be realized from the application of this work. While the immediate effect will be to assist program managers in evaluating and improving program performance, the ultimate benefits will accrue to the producing industry, the states, and the nation in the form of sustained or increased domestic oil production. This benefit depends also, of course, on the effectiveness of the technology being transferred. The managers of the Technology Transfer program, and the larger federal oil and gas R&D programs, will be provided with a means to design and assess the effectiveness of program efforts as they are developed, tested and performed. The framework allows deficiencies in critical aspects of the program to be quickly identified, allowing for timely corrections and improvements. The actual process of developing the evaluation also gives the staff of the Oil R&D Program or Technology Transfer subprogram the opportunity to become oriented to the overall program goals. The structure and focus imposed by the evaluation paradigm will guide program staff in selecting activities which are consistent with achieving the goals of the overall R&D program.

32264 (DOE/BC/14853–4) **Continued support of "The Natural Resources Information System (NRIS) for the State of Oklahoma": Quarterly technical progress report, April 1, 1993–June 30, 1993.** Mankin, C.J. (Oklahoma Geological Survey, Norman, OK (United States)); Rizzuti, T.P. Oklahoma Geological Survey, Norman, OK (United States); Oklahoma Univ., Norman, OK (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-92BC14853. Order Number DE93040007. Source: OSTI; NTIS; GPO Dep.

The objective of this research program is to continue developing, editing, maintaining, utilizing and making publicly available the Oil and Gas Well History file portion of the Natural Resources Information System (NRIS) for the State of Oklahoma. The Oklahoma Geological Survey, working with Geological Information Systems at the University of Oklahoma Sarkeys Energy Center, has undertaken to construct this information system in response to the need for a computerized, centrally located library containing accurate, detailed information on the state's natural resources. Particular emphasis during this phase of NRIS development is being placed on computerizing information related to the energy needs of the nation, specifically oil and gas. The NRIS Well History file contains historical and recent completion records for oil and gas wells reported to the Oklahoma Corporation Commission on Form 1002-A. At the start of this quarter, the Well History file contained 310,890 records, providing geographical coverage for most of Oklahoma (all buc the northeast part of the State). Data elements on this file include API well number, lease name and well number, location information, elevations, dates of significant activities for the well and formation items (e.g., formation names, completion and test data, depths and perforations). In addition to the standard Well History file processing, special projects are undertaken to add supplemental data to the file from well logs, scout tickets, and core and sample documentation.

32265 (DOE/BC/14883–3) **Surfactant-enhanced alkaline flooding for light oil recovery: [Quarterly] report, March 31–June 30, 1993.** Wasan, D.T. Illinois Inst. of Tech., Chicago, IL (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92BC14883. Order Number DE93040008. Source: OSTI; NTIS; GPO Dep.

The overall objective of this project is to develop a very cost- effective method for formulating a successful surfactant-enhanced alkaline flood by appropriately choosing mixed alkalis which form inexpensive buffers to obtain the desired pH (between 8.5 and 12.0) for ultimate spontaneous emulsification and ultra-low tension. In addition, the novel concept of pH gradient design to optimize flood water conditions will be tested. Last quarter we have investigated the mechanisms responsible for spontaneous emulsification in alkali/acidic crude oil systems with and without added surfactant. We have observed that the roll cell size and formation time depend strongly on the pH and ionic strength of the alkaline solution. For a particular roll cell size, the addition of surfactant causes the cells to take longer to form, causing an interfacial resistance to mass transfer and making the interface more rigid. We have shown that interfacial turbulence is a necessary but not sufficient condition for spontaneous emulsification. Low interfacial tension is also a necessary condition. This quarter a microwave interferometric procedure was developed for the determination of low water content (0. 5 to 10 vol%) of water-in-oil macroemulsions. The apparatus operates at a frequency of 23.48 GHz in the K-band microwave region. The procedure is based on the large differences in dielectric properties between water and oil, and it utilizes the variation in phase shift as sample path length is varied. Measurements are accurate to within 0.5 vol% water.

32266 (DOE/BC/14955–1) **Applications of advanced petroleum production technology and water alternating gas injection for enhanced oil recovery – Mattoon Oil Field, Illinois: First quarterly technical progress report, 1993.** Baroni, M.R. American Oil Recovery, Inc., Mattoon, IL (United States). 24 May 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-93BC14955. Order Number DE93019958. Source: OSTI; NTIS; GPO Dep.

For work during the first quarter of 1993, American Oil Recovery, Inc. targeted completion of the following specific objectives: Convene meetings of Mattoon Project subcontractors in order to plan and coordinate Project activities. Confirm organizational arrangements and plans for implementation of Mattoon Project. Complete most work on detailed analysis of reservoir geology of productive leases in the Mattoon Project. Identify first Facies Defined Subunit for initial injectivity testing to be commenced near the beginning of the second quarter. Identify additional Facies Defined Subunits for injectivity testing and characterization during the second and third quarters. Award subcontract to the Illinois State Geological Survey and commence work on preparation of a geostatistical model (STRATAMODEL) of more than 100 wells on 1,000 acres within the Mattoon Project Area. Obtain oil samples from wells in the identified Facies Subunit for reservoir rock, fluid, and CO_2 compatibility testing by the Illinois State Geological Survey. Design CO_2 injection pumps and injection monitoring equipment configuration. Obtain bids for required pumps and diesel motor. Accomplishments for this quarter are reported.

32267 (DOE/BC/14958–3) **Green River Formation Water Flood Demonstration Project, Uinta Basin, Utah: Quarterly technical progress report, April 1, 1993–June 30, 1993.** Lomax, J.D. (Lomax Exploration Co., Salt Lake City, UT (United States)); Nielson, D.L.; Deo, M.D. Lomax Exploration Co., Salt Lake City, UT (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-93BC14958. Order Number DE93040010. Source: OSTI; NTIS; GPO Dep.

The project is designed to increase recoverable petroleum reserves in the United States. The Green River Formation in Utah's Uinta Basin contains abundant hydrocarbons that are not easily recovered by primary means. The successful Lomax Monument Butte Unit water flood will be evaluated under this contract, and based on this information, water floods will be initiated in nearby Travis and Boundary units. In 1987, Lomax Exploration Company started a water flood in the Monument Butte Unit of a Douglas Creek member of the Green River Formation. This was a low-energy, geologically heterogeneous reservoir producing a waxy crude oil. Primary production yielded about 5% of the OOIP. Due to the water flood project, total production will yield an estimated recovery of 20% OOIP. The Monument Butte Unit #10-34 and the Travis Unit #14A-28 were put on production the last quarter of 1992. Formation Microimaging and Magnetic Resonance Imaging logs were used to evaluate these wells as commercially productive. Through June 30, 1993, the Monument Butte # 10-34 (11/27/92 first production) has produced 6,277 barrels of oil and 6.5 MMcf of gas and the Travis #14A-28 (1/1/93 first production) has produced 7,717 barrels of oil and 19.9 MMcf of gas.

32268 (DOE/CE/15510–T6) **Oilwell Power Controller (OPC).** Double M Electric, Inc., Watford City, ND (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-91CE15510. Order Number DE93019244. Source: OSTI; NTIS; GPO Dep.

The Oil Well Power Controller (OPC) prototype units is nearing completion. This device is an oilwell beam pump controller and data logger. Applications for this device have been for an electrical power saving device, pump off control, parafffin detection, demand power load control, chemical treatment data, dynamometer and pump efficiency data. Preliminary results appear vary promising. A total of ten OPC rod pump controllers were assembled and installed on oilwells in several areas of Central and Western United States. Data was analyzed on these wells and forwarded to the participating oil companies. Cost savings on each individual oil well participating in the OPC testing vary considerably, savings on some situations have been outstanding. In situations where the pump efficiency was determined to be low, the cost savings have been considerable. Cost savings due to preventive maintenance are also present, but are difficult to pin point an exact dollar amount at the present time. A break out of actual cost data obtained on some of the oilwells controlled and monitored with the oilwell power controller.

32269 (DOE/CE/15510–T8) **Oilwell Power Controller (OPC Unit): Technical report.** Double M Electric, Inc., Watford City, ND (United States). [1993]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-91CE15510. Order Number DE93040514. Source: OSTI; NTIS; GPO Dep.

Double M Electric, Inc. in Watford City, ND is finalizing the testing of its Oilwell Power Controller (OPC) Prototype Unit. This device can be used as a rod pump controller and it can also monitor, record and store power usage, temperature and pressure data. The unit also has the capability to measure the rod string weight, therefore it can be used as a dynamometer. A total of 10 OPC Units were assembled and installed on oilwells pumped with rod pumps in the Central and Western United States. Data from these wells was analyzed and forwarded to the participating oil companies.

32270 (DOE/CE/15517–T6) **Instrumentation of Dynamic Gas Pulse Loading system: Final technical report.** Mohaupt, H. Servo-Dynamics, Inc., Santa Barbara, CA (United States). 31 Jul 1993. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-91CE15517. Order Number DE93019029. Source: OSTI; NTIS; GPO Dep.

The Dynamic Gas Pulse Loading (DGPL) process is an hydraulic fracturing method which uses CO_2 and CO gas as a working fluid instead of a liquid. The DGPL system can be used to generate fractures for horizontal and vertical oil and gas well completions in both open hole and perforated casing. The DGPL system provides a cost effective tool for repairing near well bore permeability damage caused by inappropriate chemical treatment, migrating fines and paraffins, or slotted liners blocked by sand. Because the gas is generated from a solid propellant material by chemical reaction, no heavy equipment is required. Tremendous pump rates can be obtained. Peak pressures are naturally localized at the tool position by the tamping effect of well fluids. Thus many of the leakage and sealing problems which plague static hydrofrac processes ore completely avoided. DGPL may be effectively used before acid treatment to provide fresh pathways for the acid to reach the formation. The smaller tools may be positioned by wireline, though most Stressfrac tools are tubing conveyed.

32271 (DOE/CE/15553–T4) **System to inject steam and produce oil from the same wellbore through downhole valve switching: Fourth quarterly report.** S-Cal Research Corp., San Rafael, CA (United States). Sep 1993. 46p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-92CE15553. Order Number DE93040365. Source: OSTI; NTIS; GPO Dep.

A Major Oil Operator indicated that they are considering drilling and completion of two horizontal wells to reach the same reservoir area in the Midway-Sunset field. This gave us an opportunity to show them the potential benefits of using a single cased well equipped with two laterals,instead of two conventional horizontal wells. This new case will require drilling a new well. Because of the relatively higher expected fluid production rate, larger-diameter latcrals will be needed. Correspondingly,this calls for a larger casing diameter. Two basic designs have been produced,for two different casing diameters, respectively 8 5/8 inch and 10 3/4 inch. A major difficulty in this case is the very low reservoir pressure (50 to 75 psig) which led us to consider two different artificial lift systems.

32272 (DOE/MC/26031–3442) **Field verification of CO_2-foam: [Quarterly] report, July 1–September 30, 1992.** Martin, F.D.; Heller, J.P.; Weiss, W.W. New Mexico Inst. of Mining and Technology, Socorro, NM (United States). New Mexico Petroleum Recovery Research Center. [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG21-89MC26031. (PRRC–92-45). Order Number DE93040682. Source: OSTI; NTIS; GPO Dep.

This project is a cooperative industry-university-government effort to transfer laboratory research technology to a field demonstration test. The primary objective of the project is to evaluate the use of foam for mobility control in a field-scale CO_2 flood. The East Vacuum Grayburg/San Andres Unit (EVGSAU), operated by Phillips Petroleum Company, is the site selected for a comprehensive evaluation of the use of foam for improving the effectiveness of a CO_2 flood. Results of laboratory work leading to the selection of a specific foaming surfactant for application at EVGSAU and additional background on the project were presented at the SPE/DOE Eighth Symposium on EOR in April 1992. During this quarter, a second paper outlining the field operating plans, design criteria, foam injection schedule, data collection program, and performance criteria

was presented at the 1992 SPE Annual Technical Conference and Exhibition.

32273 (NEI-NO–351) **Diffusion coefficient measurements in gas/oil mixtures at high pressure by nuclear magnetic resonance.** Helbaek, M. Trondheim Univ. (Norway). Norges Tekniske Hoegskole. Nov 1992. 152p. Order Number DE93516705. Source: OSTI; NTIS.

The aim of this work was to develop and construct essential nuclear magnetic resonance (NMR)- and high pressure equipment for diffusion measurements, and to provide accurate self diffusion data for binary and multi-component mixtures of selected gaseous and liquid hydrocarbons under high pressure and at elevated temperatures. The results will enable direct modeling of diffusive mass transfer processes which may contribute to several reservoir processes including displacement processes upon gas injection, dissolution processes of gases in stagnant liquids, diffusion through cap rock, and hydrocarbon migration from the source rock to the reservoir. Diffusion data in hydrocarbon systems are important for several processes. Planning and evaluation of enhanced oil recovery by gas injection is one example. Other examples are heterogeneous catalytic reactions, transport in membranes (biological systems), and electrode reactions. The diffusion of interest in these processes is the mutual diffusion of different components caused by concentration gradients. Molecules will also move in a liquid without concentration gradients. This is the self diffusion. For NMR measurements on gas/liquid mixtures, a high-pressure glass capillary is used as sample vessel. The high pressure equipment includes in addition a high pressure pump, a pressure line, and a sample container equipped with a piston to separate the pressure medium from the sample. The glass capillary containing the gas/liquid mixture is located in the NMR detection system during measurements. Diffusion data have also been calculated from some selected correlations. Significant deviations are observed from experimental data. 57 refs., 55 figs., 8 tabs.

32274 (NEI-NO–352) **Cloud-points of hydrocarbon systems: Influence of pressure and methane addition.** Brockmann, A.R. Trondheim Univ. (Norway). Norges Tekniske Hoegskole. Dec 1992. 118p. Order Number DE93516706. Source: OSTI; NTIS.

Cloud-points are described as the temperature for the first observed appearance of solid particles in a solution when it is cooled. Studies of cloud-points in hydrocarbon systems as crude oils and diesel fuels performed by others, have been described. The mathematical framework for cloud-points and liquidus in hydrocarbon systems, is presented. Measurements of cloud-points at 1 atm were performed in a test jar placed on a magnetic stirrer. The test jar containing the sample was heated to the melting point of the solid particles, described as wax, and then cooled by air. The appearance of wax crystals in the solution was registered by a laser-detector arrangement. As solid particles are formed the light beam passing through the sample is scattered. The cloud-point was registered as an increased light intensity on the detector. Measurements of wax precipitation at elevated pressures were performed with a visual high pressure cell. Cloud-point measurements have been performed on systems containing from 1 to 8 wt % wax, from 1 atmospheric pressure and up to 250 bar. The amount of methane added was up to 8 wt % and all measurements were performed in the one phase region. Measurements were also performed on a gas condensate as solvent added a wax forming component and methane. The average standard deviation of the 1 atm measurements was ± 0.17°C. For the measurements at elevated pressures, the estimated standard deviation was ± 0.20°C. A general model has been developed based on the experimental results. The model describes cloud-point as a function of composition and pressure for a single precipitating component. For the modeling work a starting point was fundamental thermodynamic equations. A 6 parameter model describes the experimental results within ± 0.29°C. 51 refs., 36 figs., 8 tabs.

32275 (NIPER–669) **Field application of foams for oil production symposium: Proceedings.** Olsen, D.K.; Sarathi, P.S. (comps.). National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States). Jul 1993. 265p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-83FE60149. (CONF-930217–: Field application of foams for oil production, Bakersfield, CA (United States), 11-12 Feb 1993). Order Number DE93000154. Source: OSTI; NTIS; GPO Dep.

The contents of this volume represent the collective presentation, entitled "Field Application of Foams for Oil Production," which was held in Bakersfield, California, February 11-12, 1993. This symposium was sponsored by the US Department of Energy (DOE) as part of its technology transfer mission and was organized by the National Institute for Petroleum and Energy Research (NIPER). The symposium was organized into two technical sessions devoted to "Thermal Foam Application" and "Gas Foam Application" and a panel session devoted to the assessment of the current state of the technology. In addition to the panel and technical sessions, a poster session devoted broadly to laboratory research on foams was held on the evening of February 11, 1993. A total of 73 participants from seven countries attended the conference and the evening poster and social hour session and made the symposium an overwhelming success. A list of attendees is appended at the end of the proceedings. A total of 13 technical papers and 8 poster abstracts were presented at the symposium and are included in these conference proceedings. These proceedings also include a summary of the panel presentation and discussions. For convenience, the proceedings are assembled into four parts, each containing related materials. The first part includes the six papers presented at the "Thermal Foam Application" session, followed by the paper discussion section. The second part includes a summary of panel presentations and discussion. The third part includes the extended abstracts of the papers presented at the poster session. The final part includes the seven papers and summary discussion presented during the "Gas Foam Application" session. The papers are included in the order in which they were presented, and the discussion section includes selected questions posed by the audience to the authors and their response.

32276 (NIPER–683) **Microbial enhanced waterflooding Mink Unit and Phoenix field pilots: Final report.** Bryant, R.S. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States)); Steep, A.K.; Bertus, K.M.; Burchfield, T.E.; Dennis, M. National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States). Jul 1993. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-83FE60149. Order Number DE93000156. Source: OSTI; NTIS; GPO Dep.

To determine the feasibility of improving oil recovery and the economics of microbial enhanced waterflooding in mature oil wells in the United States, two field pilots have been conducted. Candidate fields were screened to determine whether they have any potential for a microbial system developed at the National Institute for Petroleum and Energy Research (NIPER), and microbial compatibility tests were conducted in the laboratory to select the target field. A specific microbial formulation was selected that was compatible with the chosen reservoir environment and had been shown to recover oil after waterflooding in Berea sandstone and field core. The microbial formulation was designed to improve microscopic oil displacement efficiency by surfactant, gas and acid production from fermentation of molasses. A 20-acre pilot test was initiated in October 1986, and completed in December 1989. Results from this pilot demonstrated that microorganisms could be injected into an ongoing waterflood and that such injection could increase oil production by at least 13%. A larger test (520 acres) was completed in the same formation to evaluate the feasibility of commercial application of the technology. This field pilot was injected with microorganisms and molasses from a centralized injection station in June 1990. Although microorganisms were injected only once per site, nutrient injection continued throughout the project life. All 19 injection wells were treated, and oil production was monitored from the 47 production wells. Injection pressures and volumes were monitored throughout the project. No operational problems were encountered. At the end of May 1993, oil production was improved by 19.6 %. Results from both projects are presented and the potential for microbial-enhanced waterflooding technology is evaluated.

32277 (NIPER–706) **[National Institute for Petroleum and Energy Research] monthly progress report for July 1993.** National Inst. for Petroleum and Energy Research, Bartlesville, OK

(United States). Aug 1993. 60p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-83FE60149. Order Number DE93019955. Source: OSTI; NTIS; GPO Dep.

Brief progress reports are presented under the following tasks: energy production research; fuels research; and supplemental Government programs. Energy production research includes: reservoir assessment and characterization; TORIS research support; development of improved microbial flooding methods; development of improved chemical flooding methods; development of improved alkaline flooding methods; mobility control and sweep improvement in chemical flooding; gas flood performance prediction improvement; mobility control, profile modification, and sweep improvement in gas flooding; three-phase relative permeability research; thermal processes for light oil recovery; thermal processes for heavy oil recovery; and imaging techniques applied to the study of fluids in porous media. Fuels research covers; development of analytical methodology for analysis of heavy crudes; and thermochemistry and thermophysical properties of organic nitrogen- and diheteroatom-containing compounds. Supplemental Government program includes: microbial-enhanced waterflooding field project; feasibility study of heavy oil recovery in the Midcontinent region: Oklahoma, Kansas, and Missouri; surfactant-enhanced alkaline flooding field project; process-engineering property measurements on heavy petroleum components; development and application of petroleum production technologies; upgrade PBO crude oil database; simulation analysis of steam-foam projects; DOE education initiative project; technology transfer to independent producers; compilation and analysis of outcrop data from the Muddy and Almond formations; implementation of oil and gas technology transfer initiative; horizontal well production from fractured reservoirs; chemical EOR workshop; and organization of UNITAR 6th International conference of Heavy Crude and Tar Sands.

32278 Laterally and vertically staggered horizontal well hydrocarbon recovery method. Brannan, G.O.; McCaffrey, W.J. To Amoco Corp. (United States). 4 Jan 1993. Filed date 3 Jul 1991. Canada patent application 2046107. 35p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

A method for producing hydrocarbons from a subterranean formation combines fluid drive and gravity drainage. The method comprises injecting a fluid through at least two upper horizontal wells out into the formation for moving hydrocarbons from the formation into at least one lower horizontal well through which the hydrocarbons are produced. Each lower horizontal well is spaced laterally and vertically below and between two respective upper horizontal wells. Hydrocarbons are produced through at least one lower horizontal well at a cumulative rate faster than the cumulative rate of the fluid injected into the upper horizontal wells. The method further comprises injecting a fluid and producing hydrocarbons as described above but with additional upper and lower horizontal wells longitudinally spaced from the first-mentioned upper and lower horizontal wells so that each of the lower horizontal wells operates as a discrete production well. Preferably, the wells are disposed to maximize the combined effects of gravity drainage and sweep efficiency caused by a continuous fluid drive force so that a reduced number of wells can be used to deplete the formation efficiently. 9 figs.

32279 Adjustable bent sub. Moore, D. 28 Dec 1992. Filed date 27 Jun 1991. Canada patent application 2045888. 12p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

When drilling for oil with downhole motors, bent subs are placed in a drill string to cause the drilling of a borehole that deviates from vertical. An adjustable bent sub is provided, consisting of a tubular body having a first and a second end. The body has a first portion adjacent the first end having a first axis, and a second portion adjacent the second end having a second axis which is offset from the first axis. A sleeve is rotatably secured to the second portion of the tubular body. The sleeve has a first end, a second end, and an interior surface with internal surface means. The sleeve has a first portion adjacent the first end having a first axis, and a second portion adjacent the second end having a second axis which is offset from the first axis. An intermediate member is non-rotatably secured to the tubular body. The intermediate member has external surface means and is axially movable along the tubular body between an engaged and a disengaged position. In the engaged position, the external surface means engage the internal surface means of the sleeve to couple the sleeve and the tubular body non-rotatably. In the disengaged position, the sleeve is rotatable in relation to the tubular body, thereby permitting the bend of the sub to be adjusted. Means are also provided for selectively locking the intermediate member in an engaged position. 6 figs.

32280 Flushing and dredging method for wellbores and equipments thereof. Kume, Shinichi. To Kanto Natural Gas Development Co., Ltd. (Japan). 8 Dec 1992. Filed date 7 Jun 1991. Canada patent application 2044011. 27p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

An easy and effective method for flushing and dredging a wellbore is described, along with the equipment used in this process. According to the method, a high pressure hose constructed of an inner resin tube and an outer resin sheath and having a jet nozzle at its leading end is lowered into a pipe, which is disposed within the wellbore, through a lubricator arranged in the wellhead equipment. Water is introduced into the high pressure hose to jet water out through the jet nozzle so that water flushes the inside of the pipe and blows up substances so flushed off and/or materials dredged up. At the same time, a compressed gas is injected through a gas-lift means provided on the pipe, whereby the flushed-off substances and dredged-up materials are discharged from the wellbore with the aid of the expanding injection gas. The invention makes it possible to flush and dredge wellbores reaching as deep as a thousand meters or more under the ground. In particular, the invention can be applied to wellbores whose diameters are so small that their cleaning and dredging have hitherto been difficult. Furthermore, the combined use of the water jet technique and the gas-lift technique allows effective dredging and flushing to be conducted concurrently. 5 figs., 2 tabs.

32281 Dual frequency microwave water cut monitoring means and method. Helms, D.A.; Durrett, M.G.; Hatton, G.J. To Texaco Development Corp. (United States). 26 Aug 1992. Filed date 25 Feb 1991. Canada patent application 2037003. 15p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

A microwave device for monitoring the water cut of a petroleum stream includes a microwave source which provides microwave energies at two different frequencies to a circulator which in turn provides the microwave energies to an antenna. The antenna provides the microwave energies to a petroleum stream and also receives reflected microwave energy back from the stream. The reflected microwave energy is provided by the antenna to the circulator which in turn provides the reflected microwave energies as test microwave energies. A detector assembly connected to the circulator detects the intensities of the test microwave energies and provides a corresponding intensity signal. Indicator apparatus connected to the circulator, to the microwave source and to the detector assembly provides an indication of the water cut of the petroleum stream in accordance with the intensity signal and the phase difference between one of the source-provided microwave energies and its corresponding test microwave energy. 1 fig.

32282 Treating underground formations. Friedman, R.H.; Surles, B.W. To Texaco Development Corp. (United States). 21 Aug 1992. Filed date 20 Feb 1991. Canada patent application 2036734. 27p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

Wells penetrating oil- and water-producing intervals may be treated to reduce the flow rate of water into the well by isolating the water-producing interval and introducing into it a volume of treating fluids sufficient to invade at least 6 in. into the water-producing interval. Cased wells may be treated to plug holes in the

casing caused by corrosion or casing breaks by introducing a treating fluid into the formation adjacent to the break. The treating fluid comprises a material which can be acid catalyzed in a period of 1-16 h at formation conditions, preferably a monomer or oligomer of furfuryl alcohol. The treating fluid contains 40-60% furfuryl alcohol and 40-60% of an ester, preferably ethyl acetate or butyl acetate. The catalyst is preferably orthonitrobenzoic acid or toluene sulfonic acid in a concentration of 1-4 wt %, selected to produce a set time at the formation temperature in the 1-16 h range. The treating fluid also contains an effective amount of 0.5-1.5 wt % of a water swelling polymer, preferably a copolymer of starch and synthetic polymer (acrylates or acrylamides) to prevent shrinkage of the furfuryl alcohol on polymerization. Field trials are described to illustrate the process of the invention. 1 tab.

32283 **Packoff nipple.** McLeod, R.D.; Roesch, A. 19 Aug 1992. Filed date 6 Dec 1991. Canada patent application 2057219. 34p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

A packoff nipple is disclosed for use on the mandrel of a wellhead isolation tool used in the services of fracturing and acidizing oil and gas wells. In one aspect, the invention comprises an improvement to existing sealing nipples in that it has on the periphery of the major diameter of its elastomeric primary seal a collapsible sealing lip which will expand and create an initial seal. The concentric sealing lip will preferably collapse inward to allow entrance into narrow passages in the wellhead and tubing without damage during installation in the wellhead. In another aspect, an elastomeric packer ring is provided with a bonded structural steel insert which will prevent the packer ring from distortion when under pressure and when the sealing nipple and mandrel are in an off-center position. In a further aspect, a double shoulder and land configuration is provided for the elastomeric packer ring to ride up on and compress or extrude into the annulus formed by the nipple body and the tubing. In a still further aspect, there is provided an elastomeric packer ring which will remain in place by friction forces when pressure on it has been released. 15 figs.

32284 **Non-crushing wellhead.** Smith, L.D.; Hoff, H.M. To Huber (J.M.) Corp. (United States). 16 Aug 1992. Filed date 15 Feb 1991. Canada patent application 2036453. 36p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

A slip suspension wellhead for axially suspending a selected tubular member in a well bore, such as a casing string in an oil well, is disclosed. According to the invention, an inclined support surface is provided with a second support surface which may contact a portion of the slip assembly to halt axial movement of the slips relative to the wellhead body. The second support surface is placed along the inclined support surface at a preselected point in order to stop the radial movement of the slip gripping faces before the inner slip diameter is compressed below the sum of the drift diameter plus two times the maximum wall thickness for the selected tubular member. Therefore, the improved wellhead of the invention may utilize slips having substantially reduced axial length without danger of crushing the tubular member. 3 figs., 1 tab.

0204 Processing

Refer also to citation(s) 32312, 32313, 33295

0205 Products and By-Products

32285 **Super acidic catalysts for the synthesis of methyl-tert-butyl-ether.** Le Van Mao, R. To Societe Quebecoise d'Initiatives Petrolieres (Canada). 11 Jan 1993. Filed date 10 Jul 1991. Canada patent application 2046694. 26p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

Methyl tert-butyl ether (MTBE) is an excellent candidate for replacing lead additives used for octane boosters in gasoline blends. MTBE is currently synthesized industrially from methanol and isobutene using catalysts, but these catalysts suffer from low yields or production of undesirable C_8 byproducts. Accordingly, a novel selective catalyst useful for synthesizing MTBE or ethyl tert-butyl ether (ETBE) is disclosed. The catalyst of the invention comprises ca 0.5-7 wt % of triflic acid (TFA) incorporated into an acid form Y zeolite. It is preferred that the TFA concentration be ca 3-5 wt % and that it be incorporated by a uniform impregnation in the presence of an organic solvent such as acetone. The resulting solid is heated at 80-150°C for 1-24 h. In its commercial use, the catalyst of the invention is preferably incorporated in an inert filler such as bentonite. The invention also provides a process for synthesizing ETBE or MTBE in the liquid phase (200 psig) at a temperature preferably from 85°C to 90°C. Such a process comprises the reaction of isobutene with ethanol (for ETBE) or methanol (for MTBE) in the presence of an acid form Y zeolite into which 0.5-7 wt % of TFA is incorporated. Experiments are described to illustrate various aspects of the invention. 7 figs., 7 tabs.

32286 **Integrated two reaction zone process for C4, C5 and C6 isomerization.** Johnson, B.H. To UOP (United States). 26 Dec 1992. Filed date 25 Jun 1991. Canada patent application 2045356. 26p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

A C_4 feedstock and a C_{5-6} feedstock are isomerized in a process that reduces equipment and operating expenses by utilizing a process flow scheme that provides beneficial heat integration and facilitates the use of a common recovery zone while permitting a wide variation in the relative ratio of a C_4 to a C_{5-6} feedstock. The C_4 feedstock is first combined with hydrogen and is then isomerized in a separate reaction zone, using an isomerization catalyst. The effluent from the C_4 isomerization is heat exchanged against or mixed with the C_{5-6} feedstock ahead of an additional isomerization zone that converts the C_{5-6} hydrocarbons, and if present, normal C_4 hydrocarbons, to more highly branched hydrocarbons. Effluents from both isomerization zones enter a common separation section that removes light gases from the isomerate product. 2 figs.

32287 **Crystalline silicate catalyst and a reforming process using the catalyst.** Miller, S.J.; Mulaskey, B.F. To Chevron Research and Technology Co. (United States). 8 Dec 1992. Filed date 7 Jun 1991. Canada patent application 2044103. 33p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

A catalytic reforming process comprises contacting a hydrocarbon feed with a catalyst that comprises at least one Group VIII metal and a crystalline silicate having a silica/alumina molar ratio of at least 500:1 and a crystallite size under 10 microns. Silicalite, an intermediate pore zeolite, is the preferred crystalline silicate and Pt is the preferred Group VIII metal. Most preferably, the silicalite catalyst has at least 95% crystallinity. The process is preferably run at 599-1058°F, in the absence of added hydrogen, and at a pressure below 100 psig. It has been discovered that reforming using a crystalline silicate catalyst comprising small crystallites with a high degree of crystallinity results in surprisingly long run lengths in the reforming process. Furthermore, when the silicate has small crystallites, it can run at lower pressures and temperatures without added hydrogen. A further advantage is that when hydrogen is not added and the reforming pressure is low, a high yield is achieved. Experiments are described which illustrate the process of the invention. 3 tabs.

32288 **Process for separating hydrogen from gas mixtures using a semi-permeable membrane consisting predominantly of polycarbonates derived from tetrahalobisphenols.** Sanders, E.S.; Overman, D.C. To Dow Chemical Co. (United States). 26 Aug 1992. Filed date 25 Feb 1991. Canada patent application 2037018. 32p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

The separation and use of hydrogen is often necessary in various processes used in the oil industry, and membranes can be used to achieve such separations. Membranes are disclosed which exhibit surprisingly high separation factors and high permeabilities for the separation of H_2 from gas mixtures. The membranes comprise a

thin discriminating layer consisting of a polycarbonate polymer derived from a tetrahalobisphenol. In a preferred embodiment, the polycarbonate is derived from 50-100% of a bisphenol of formula 1, and 0-50% of a bisphenol of formula 2. In both formulas, the radical joining the phenol groups is a C_{1-6} divalent hydrocarbon radical; the halogen in formula 1 is Cl or Br. Formula 2 is similar to formula 1 except that the halogens are replaced by C_{1-4} alkyl. In an embodiment where at least 35 wt % of the moieties derived from formula 1 present in the discriminating layer bear halogen groups which are exclusively Br, the separation factor for hydrogen and light hydrocarbons at 25°C is at least 100. Furthermore, the membranes of the invention have good mechanical properties and are thus useful under more extreme pressures and/or temperatures. A process for forming the membranes is also disclosed. A process for using them to separate hydrogen from gas mixtures containing gases such as N_2, CO, CO_2, and light hydrocarbons in addition to H_2 comprises contacting a feed gas stream containing hydrogen with the membrane under conditions such that hydrogen selectively penetrates through the membrane in comparison to the other components. Results of tests are presented to illustrate the separations attainable with membranes of the invention. 4 tabs.

0206 Health and Safety

32289 (NEI-NO–355) **Some aspects of floating ice related to sea surface operations in the Barents sea.** Loeset, S. Trondheim Univ. (Norway). Norges Tekniske Hoegskole. Jan 1993. 169p. Order Number DE93525287. Source: OSTI; NTIS; INIS.

The present work highlights some aspects of floating ice related to sea surface operations in the Barents sea. The thesis consists of eight papers which fall into two main categories; one part deals with numerical modeling of the temperature distribution and ablation of icebergs (three papers), and the other part studies the behavior of broken ice, focusing on both laboratory experiments and numerical modeling. The temperature distribution within an iceberg affects the mechanical strength of the ice and is therefore crucial in engineering applications when estimating loads from impinging icebergs on offshore structures. A numerical model which simulates the temperature distribution and ablation of icebergs has been developed. The model shows that the depth of the thermal disturbance and slope of the temperature gradient of an iceberg depend on the boundary conditions and the time at sea. By about 12 m into the ice, the temperature is virtually free of any thermal boundary influence. Oil spill response techniques are vulnerable to the presence of sea ice. Deflecting ice upstream of a spill site by means of a flexible boom will facilitate the application of conventional oil spill recovery systems such as oil skimmers and booms. Experiments with such an ice deflecting boom were conducted in an ice tank to determine the loads on the boom and to study the ice-free wake. The study indicated the technical feasibility of the ice boom concept as an operational tool for oil spill cleanups. A two-dimensional discrete element model has been developed. This model simulates the dynamics and interaction forces between distinct ice floes in a broken ice field. The numerical model was applied to estimate the loads on a boom used for ice management. 121 refs., 70 figs., 10 tabs.

32290 **Process and devices for closing-off high pressure and high flow tubes, in particular tubes derived from burning oil wells.** Barski, V.; Dreyfus, D. 9 Jan 1993. Filed date 8 Jul 1991. Canada patent application 2046492. 8p. (In French). Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

The disadvantages of conventional methods for shutting off the flow of fluid from burning oil wells can be overcome by the emplacement of a special shutoff valve below the main valves of the well, within a subterranean tunnel. According to the invention, it is proposed to install a shutoff valve below the main valves of the well, within a rigid enclosure fixed to the well pipe and equipped with an assembly of seals, allowing the introduction of a piercing and/or shutoff element and stopping the flow of oil in order to extinguish the fire. This enables repair and/or installation of main valves and removal of the shutoff valve in a manner that ensures that the well pipe is sealed tight and the initial production capacity of the well can resume. 7 figs.

32291 **Oil well fire fighting tool.** Von Braun, D. 5 Jan 1993. Filed date 4 Jul 1991. Canada patent application 2046266. 11p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

A tool for fighting oil well fires is provided which is able to confront a variety of situations in its operational mode. The tool also can work at different levels and can go below the surface by means of a trench mined into position. The tool is a clamping device for securing a tubular sleeve around the well casing in order that a hole may be drilled through the casing. When this operation is completed and the tool is withdrawn, a second tubular arrangement is set in its place. A variety of sealing materials can then be injected into the well casing to shut and contain the flow of fluid or gases. Various procedures can be used, especially in the case of dual barrels in a piggyback arrangement. This procedure enables a volume of mud, fluid, or gases to be pumped into the well casing to shut, stabilize, or control the well. 18 figs.

32292 **Oil well fire suppression system.** Wagner, H.G.; Doucet, O.J. 4 Dec 1992. Filed date 3 Jun 1991. Canada patent application 2043802. 15p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

At an oil well fire, a T-shaped pipe is employed to cover the exposed oil pipe at or near ground level and redirect the flow of oil away from the flame. After initial placement by either crane or helicopter over the oil flow, the oil will flow unimpeded through the vertical pipe section and the fire will still be burning above the device. At this point, a cable with a sphere attached to it is pulled through the other pipe section at about 90 degrees to the oil flow. Eventually, the sphere is pulled up against an annular ring in the neck of the vertical pipe section and closes off the flow of oil in this direction. Oil now flows parallel to the ground and exits the pipe some 15 ft. from the flames. The flames die out due to lack of fuel. The method requires little water and can be applied to any fire which does not have a wellhead so large or misshapen that the device cannot be placed over the oil flow. The method does not require any explosives, reducing the inherent risk to workers. 9 figs.

0207 Economic, Industrial, and Business Aspects

Refer also to citation(s) 33036, 33037, 33038, 33039

32293 (DOE/EI/22627–T2) **No. 2 heating oil/propane program: Final report, 1992/93.** McBrien, J. Massachusetts Executive Office of Consumer Affairs and Business Regulation, Boston, MA (United States). Div. of Energy Resources. May 1993. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC01-91EI22627. Order Number DE93019463. Source: OSTI; NTIS; GPO Dep.

During the 1992–93 heating season, the Massachusetts Division Energy Resources (DOER) participated in a joint data collection program between several state energy offices and the federal Department of Energy's (DOE) Energy Information Administration (EIA). The purpose of the program was to collect and monitor retail and wholesale heating oil and propane prices and inventories from October, 1992 through March, 1993. This final report begins with an overview of the unique events which had an impact on the petroleum markets prior to and during the reporting period. Next, the report summarizes the results from residential heating oil and propane price surveys conducted by DOER over the 1992–93 heating season. The report also incorporates the wholesale heating oil and propane prices and inventories collected by the EIA and distributed to the states. Finally, the report outlines DOER's use of the data.

32294 (DOE/EIA–0109(93/07)) **Petroleum supply monthly, July 1993.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 29 Jul 1993. 182p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93018405. Source: OSTI; NTIS; GPO; GPO Dep.

Data presented in the Petroleum Supply Monthly (PSM) describe the supply and disposition of petroleum products in the United States and major US geographic regions. The data series describe production, imports and exports, inter-Petroleum Administration for Defense (PAD) District movements, and inventories by the primary suppliers of petroleum products in the United States (50 States and the District of Columbia). The reporting universe includes those petroleum sectors in primary supply. Included are: Petroleum refiners, motor gasoline blenders, operators of natural gas processing plants and fractionators, inter-PAD transporters, importers, and major inventory holders of petroleum products and crude oil. When aggregated, the data reported by these sectors approximately represent the consumption of petroleum products in the United States.

32295 (DOE/EIA–0130(93/07)) **Natural gas monthly, July 1993.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 27 Jul 1993. 125p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93018127. Source: OSTI; NTIS; GPO; GPO Dep.

The Natural Gas Monthly NGM highlights activities, events, and analyses of interest to public and private sector organizations associated with the natural gas industry. Volume and price data are presented each month for natural gas production, distribution, consumption, and interstate pipeline activities. Producer-related activities and underground storage data are also reported. From time to time, the NGM features articles designed to assist readers in using and interpreting natural gas information.

32296 (DOE/EIA–0380(93/07)) **Petroleum marketing monthly, July 1993.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 15 Jul 1993. 179p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93017435. Source: OSTI; NTIS; GPO; GPO Dep.

The Petroleum Marketing Monthly (PMM) is designed to give information and statistical data about a variety of crude oils and refined petroleum products. The publication provides statistics on crude oil costs and refined petroleum products sales for use by industry, government, private sector analysts, educational institutions, and consumers. Data on crude oil include the domestic first purchase price, the f.o.b. and landed cost of imported crude oil, and the refiners' acquisition cost of crude oil. Sales data for motor gasoline, distillates, residuals, aviation fuels, kerosene, and propane are presented.

32297 (DOE/EIA–0380(93/08)) **Petroleum marketing monthly, August 1993.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 10 Aug 1993. 200p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93019384. Source: OSTI; NTIS; GPO; GPO Dep.

The Petroleum Marketing Monthly (PMM) is designed to give information and statistical data about a variety of crude oils and refined petroleum products. The publication provides statistics on crude oil costs and refined petroleum products sales for use by industry, government, private sector analysts, educational institutions, and consumers. Data on crude oil include the domestic first purchase price, the f.o.b. and landed cost of imported crude oil, and the refiners' acquisition cost of crude oil. Sales data for motor gasoline, distillates, residuals, aviation fuels, kerosene, and propane are presented.

32298 (DOE/EIA–0520(93/06)) **International petroleum statistics report, June 1993.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 28 Jun 1993. 69p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93016639. Source: OSTI; NTIS; GPO; GPO Dep.

The International Petroleum Statistics Report presents data on international oil production, demand, imports, exports, and stocks. The report has four sections. Section 1 contains time series data on world oil production, and on oil demand and stocks in the Organization for Economic Cooperation and Development (OECD) . This section contains annual data beginning in 1980, and monthly data for the most recent two years. Section 2 presents an oil supply/demand balance for world. This balance is presented in quarterly intervals for the most recent two years. Section 3 presents data on oil imports by OECD countries. This section contains annual data for the most recent year, quarterly data for the most recent two clusters, and monthly data for the most recent twelve months. Section 4 presents annual time series data on world oil production and oil stocks, demand, and trade for the years 1970 through 1992; OECD stocks from 1973 through 1992; and OECD trade from 1982 through 1992.

32299 (DOE/EIA–0520(93/07)) **International petroleum statistics report, July 1993.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 27 Jul 1993. 62p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93018041. Source: OSTI; NTIS; GPO; GPO Dep.

The International Petroleum Statistics Report presents data on international oil production, demand, imports, exports, and stocks. The report has four sections. Section 1 contains time series data on world oil production, and on oil demand and stocks in the Organization for Economic Cooperation and Development (OECD). This section contains annual data beginning in 1980, and monthly data for the most recent two years. Section 2 presents an oil supply/demand balance for world. This balance is presented in quarterly intervals for the most recent two years. Section 3 presents data on oil imports by OECD counties. This section contains annual data for the most recent year, quarterly data for the most recent two quarters, and monthly data for the most recent twelve months. Section 4 presents annual time series data on world oil production and oil stocks, demand, and trade in OECD countries. World oil production and OECD demand data are for the years 1970 through 1992; OECD stocks from 1973 through 1992; OECD trade from 1982 through 1992.

32300 (DOE/EIA/TR–0567) **Largest US oil and gas fields, August 1993.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 6 Aug 1993. 66p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93018993. Source: OSTI; NTIS; GPO; INIS; GPO Dep.

The Largest US Oil and Gas Fields is a technical report and part of an Energy Information Administration (EIA) series presenting distributions of US crude oil and natural gas resources, developed using field-level data collected by EIA's annual survey of oil and gas proved reserves. The series' objective is to provide useful information beyond that routinely presented in the EIA annual report on crude oil and natural gas reserves. These special reports also will provide oil and gas resource analysts with a fuller understanding of the nature of US crude oil and natural gas occurrence, both at the macro level and with respect to the specific subjects addressed. The series' approach is to integrate EIA's crude oil and natural gas survey data with related data obtained from other authoritative sources, and then to present illustrations and analyses of interest to a broad spectrum of energy information users ranging from the general public to oil and gas industry personnel.

32301 (DOE/FE–0275) **Naval Petroleum and Oil Shale Reserves: Annual report of operations, Fiscal year 1992.** USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States). 1992. 63p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93018119. Source: OSTI; NTIS; INIS; GPO Dep.

During fiscal year 1992, the reserves generated $473 million in revenues, a $181 million decrease from the fiscal year 1991 revenues, primarily due to significant decreases in oil and natural gas prices. Total costs were $200 million, resulting in net cash flow of $273 million, compared with $454 million in fiscal year 1991. From 1976 through fiscal year 1992, the Naval Petroleum and Oil Shale Reserves generated more than $15 billion in revenues and a net operating income after costs of $12.5 billion. In fiscal year 1992, production at the Naval Petroleum Reserves at maximum efficient rates yielded 26 million barrels of crude oil, 119 billion cubic feet of natural gas, and 164 million gallons of natural gas liquids. From April to November 1992, senior managers from the Naval Petroleum and Oil Shale Reserves held a series of three workshops in Boulder, Colorado, in order to build a comprehensive Strategic Plan as required by Secretary of Energy Notice 25A-91. Other highlights are presented for the following: Naval Petroleum Reserve No. 1–production achievements, crude oil shipments to the

strategic petroleum reserve, horizontal drilling, shallow oil zone gas injection project, environment and safety, and vanpool program; Naval Petroleum Reserve No. 2–new management and operating contractor and exploration drilling; Naval Petroleum Reserve No. 3–steamflood; Naval Oil Shale Reserves–protection program; and Tiger Team environmental assessment of the Naval Petroleum and Oil Shale Reserves in Colorado, Utah, and Wyoming.

32302 (NIPER–606) **Estimates of future regional heavy oil production at three production rates–background information for assessing effects in the US refining industry.** Olsen, D.K. National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States). Jul 1993. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-83FE60149. Order Number DE93000153. Source: OSTI; NTIS; INIS; GPO Dep.

This report is one of a series of publications from a project considering the feasibility of increasing domestic heavy oil (10° to 20° API gravity inclusive) production being conducted for the US Department of Energy. The report includes projections of future heavy oil production at three production levels: 900,000; 500,000; and 300,000 BOPD above the current 1992 heavy oil production level of 750,000 BOPD. These free market scenario projections include time frames and locations. Production projections through a second scenario were developed to examine which heavy oil areas would be developed if significant changes in the US petroleum industry occurred. The production data helps to define the possible constraints (impact) of increased heavy oil production on the US refining industry (the subject of a future report). Constraints include a low oil price and low rate of return. Heavy oil has high production, transportation, and refining cost per barrel as compared to light oil. The resource is known, but the right mix of technology and investment is required to bring about significant expansion of heavy oil production in the US.

0208 Waste Management

32303 (DOE/MT/92011–4) **Hydrogeochemical and production controls on NORM in oil- and gas- field operations: Technical progress report, April 1, 1993–June 30, 1993.** Fisher, R.S. Texas Univ., Austin, TX (United States). Bureau of Economic Geology. 30 Jul 1993. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92MT92011. Order Number DE93040028. Source: OSTI; NTIS; GPO Dep.

The goal of this project is to investigate the geochemical, geological, and production parameters that control the occurrence of naturally occurring radioactive materials (NORM) in oil-and gas-field operations, Activities during the second quarter of 1993 focused on identifying field sample sites, identifying previously analyzed produced-water samples that are suitable for NORM analysis, establishing methods for analyzing radium in produced water and scale, and modifying existing geochemical modeling codes to predict radium coprecipitation with carbonate and sulfate scale on the basis of thermodynamic properties.

32304 (WHC-SD-EN-TI–136) **100-N Area underground storage tank closures.** Rowley, C.A. Westinghouse Hanford Co., Richland, WA (United States). [1993]. 355p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018744. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the removal/characterization actions concerning underground storage tanks (UST) at the 100-N Area. Included are 105-N-LFT, 182-N-1-DT, 182-N-2-DT, 182-N-3-DT, 100-N-SS-27, and 100-N-SS-28. The text of this report gives a summary of remedial activities. In addition, correspondence relating to UST closures can be found in Appendix B. Appendix C contains copies of Unusual Occurrence Reports, and validated sampling data results comprise Appendix D.

32305 **Reactor for processing a catalyst material.** Wilson, M.F.; Steel, T.M.; Duley, W.W. To Minister of Energy, Mines and Resources Canada (Canada). 17 Nov 1992. Filed date 16 May 1991. Canada patent application 2042801. 27p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

A reactor for processing a catalyst material comprises a reaction chamber including a support for the material to be processed. A laser radiation entry means, a gas inlet, and an exhaust are provided, each in communication with the reaction chamber. The gas inlet permits entry into the chamber of an oxidizing gas which assists in processing the catalyst material when exposed to laser radiation (preferably pulsed-continuous wave) entering the chamber. Any resulting exhaust gases are then removed from the chamber through the exhaust. A drive means is provided to move the support in a manner such that the catalyst is moved through the laser radiation. The apparatus of the invention is useful for reactivation of deactivated catalysts, preferably hydroprocessing catalysts which are susceptible to deactivation by coke fouling. The reactor of the invention can be used to remove a substantial amount of the carbonaceous material from the surface of such catalysts via photochemically induced chemical reaction of the material with the oxidizing gas, resulting in a minimum of sintering and/or agglomeration of the catalyst. 10 figs.

0209 Environmental Aspects

Refer also to citation(s) 32289, 33002, 33828, 33970

32306 (EGG-CEE–10818) **Summary of activities to remove the aircraft hydrant system (Panero site) at March Air Force Base, California.** Hendrian, G.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jun 1993. 70p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93018978. Source: OSTI; NTIS; INIS; GPO Dep.

This document summarizes the activities to remove the underground storage tank farm (Panero Site, Operable Unit 3, Installation Restoration Program) used for aircraft refueling at March AFB. This summary report is organized into four sections: introduction–gives the scope, information summary, and composition of the report; planned work scope–states the scope of work as provided in the Performance Work Statement for Removal of Aircraft Fuel Hydrant System March Air Force Base, California; demolition results–records the accomplishments for each task defined in the Performance Work Statement; and recycling efforts–record the efforts to reduce generating unnecessary waste.

32307 (IR-CR–93074) **Preliminary assessment report for National Guard Training Center, Georgia Army National Guard, Fort Stewart, Georgia: Installation restoration program.** Argonne National Lab., IL (United States). Jul 1993. 54p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93019476. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the results of the preliminary assessment (PA) conducted by Argonne National Laboratory at the Georgia Army National Guard (GAARNG) facility near Hinesville, Georgia, known as the National Guard Training Center (NGTC). Preliminary assessments of federal facilities are being conducted to compile the information necessary for completing preremedial activities and to provide a priority basis for completing corrective actions (where necessary) in response to releases of hazardous substances. The principal objective of the PA is to characterize the site accurately and determine the need for further action by examining previous site activities, types and quantities of hazardous substances utilized, and potential pathways by which contamination could affect public health and the environment. The scope of this assessment is limited to the facilities and past activities contained within the NGTC. Preliminary assessment site score sheet information is also provided for the NGTC. However, this assessment report is intended to be read in conjunction with a previous IRP assessment of Fort Stewart completed in 1992 (USATHAMA 1992) and to provide comprehensive information on the NGTC area for incorporation with information contained in that previous assessment for the entirety of Fort Stewart.

32308 **Process to solidify oil on land and sea.** Nelson, W.E. 16 Aug 1992. Filed date 15 Feb 1991. Canada patent application 2036396. 16p. Source: Micromedia Ltd., Technical Information

Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

A process is provided for altering spilled oil to a non-adhesive, non-contaminating solid for safe removal of oil spills from land and sea. According to the invention, cold granulated or powdered wax is applied to the oil so that it dissolves in the wax to form a semi-solid. Powdered wax is preferred since it has a shorter setting time. Powdered wax can be prepared from granulated wax, the smallest size produced by refineries, by blending it with dry ice, adding a cycloolefin polymer, and pulverizing the resulting mixture. Methods of application of the wax include air delivery by low-flying aircraft, similar to crop dusters, using air pressure equipment; spraying from boats; and hand application in areas not accessible by boat or air. Skids pulled by light machinery can then be used to pull the oil/wax solid from beaches. Nets or screens attached to boats could be used to collect and remove floating wax/oil solid on water. Nets can be spread over oil-coated water prior to applying wax; the wax/oil solid will then cling to the nets, which can be winched from the water. About 1,000 lb of wax will solidify 7,000 yd^3 of oil-coated beach or water surface.

0220 Transport, Handling, and Storage

Refer also to citation(s) 32274, 33411, 33435

32309 (DOE/MT/92012–4) **Evaluation of using cyclocranes to support drilling and production of oil and gas in wetland areas: Fourth quarterly technical progress report, Second quarter, 1993.** Eggington, W.J. Mission Research Corp., San Diego, CA (United States). [1993]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92MT92012. Order Number DE93040027. Source: OSTI; NTIS; GPO Dep.

The planned program falls under wetlands area research related to drilling, production, and transportation of oil and gas resources. Specifically the planned program addresses an evaluation of using cyclocraft to transport drill rigs, mud, pipes and other materials and equipment in a cost effective and environmentally safe manner to support oil and gas drilling and production operations in wetland areas. The cyclocraft is a proven hybrid aircraft that utilizes aerostatic and aerodynamic lift. This type of aircraft has considerable payload capacity, VTOL capability, high controllability, low operating cost, low downwash and high safety. The benefits of using a cyclocraft to transport drill rigs and materials over environmentally-sensitive surfaces would be significant. The cyclocraft has considerable cost and operational advantages over the helicopter. The major activity during the second quarter of 1993 was focussed on completion of Task 4, Preliminary Design. The selected design has been designated H.1 Cyclocraft by MRC. Also during the report period, Task 6, Ground Support, was completed and a report containing the results was submitted to DOE. This task addressed the complete H.1 Cyclocraft system, i.e. it included the need personnel, facilities and equipment to support cyclocraft operations in wetland areas.

32310 (SAND–92-2283) **Anomalous zones in Gulf Coast Salt domes with special reference to Big Hill, TX, and Weeks Island, LA.** Neal, J.T. (Sandia National Labs., Albuquerque, NM (United States)); Magorian, T.R.; Thoms, R.L.; Autin, W.J.; McCulloh, R.P.; Denzler, S.; Byrne, K.O. Sandia National Labs., Albuquerque, NM (United States). Jul 1993. 65p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93019308. Source: OSTI; NTIS; GPO Dep.

Anomalous features in Gulf Coast Salt domes exhibit deviations from normally pure salt and vary widely in form from one dome to the next, ranging considerably in length and width. They have affected both conventional and solution mining in several ways. Gas outbursts, insolubles, and potash (especially carnallite) have led to the breakage of tubing in a number of caverns, and caused irregular shapes of many caverns through preferential leaching. Such anomalous features essentially have limited the lateral extent of conventional mining at several salt mines, and led to accidents and even the closing of several other mines. Such anomalous features, are often aligned in anomalous zones, and appear to be related to diapiric processes of salt dome development. Evidence indicates that anomalous zones are found between salt spines, where the differential salt intrusion accumulates other materials: Anhydrite bands which are relatively strong, and other, weaker impurities. Shear zones and fault displacement detected at Big Hill and Weeks Island domes have not yet had any known adverse impacts on SPR oil storage, but new caverns at these sites conceivably may encounter some potentially adverse conditions. Seismic reflection profiles at Big Hill dome have shown numerous fractures and faults in the caprock, and verified the earlier recognition of a major shear zone transecting the entire salt stock and forming a graben in the overlying caprock. Casing that is placed in such zones can be at risk. Knowledge of these zones should create awareness of possible effects rather than preclude the future emplacement of caverns. To the extent possible, major anomalous zones and salt stock boundaries should be avoided. Shear zones along overhangs may be particularly hazardous, and otherwise unknown valleys in the top of salt may occur along shear zones. These zones often can be mapped geophysically, especially with high-resolution seismic techniques.

32311 (SAND–93-1180C) **Evaluation of calcium silicate and calcium aluminate concretes for internal pipeline corrosion protection.** Buchheit, R.G. (Sandia National Labs., Albuquerque, NM (United States)); Hinkebein, T.E.; Hlava, P.F.; Maestas, L.M.; Melton, D.G. Sandia National Labs., Albuquerque, NM (United States). [1993]. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-931024–2: 184. meeting of the Electrochemical Society, New Orleans, LA (United States), 10-15 Oct 1993). Order Number DE93016867. Source: OSTI; NTIS; GPO Dep.

A variety of industrial-standard and experimental concretes are being evaluated for use in brine disposal pipelines operated by the US Strategic Petroleum Reserve (SPR). This paper reports on interim performance results from on-going studies involving an American Petroleum Institute (API) standard calcium silicate-based (CS) concrete and a commercially available calcium aluminate-based (CA) concrete. Samples exposed to non-flowing SPR brine in the field were returned to the laboratory at regular intervals for analysis. Electron probe microanalysis (EPMA) determined the depth of brine penetration and the amount of concrete deterioration. Corrosion occurring at steel pipe/concrete interfaces during exposure to simulated brine has been studied on laboratory-constructed specimens using electrochemical impedance spectroscopy (EIS).

0230 Properties and Composition

Refer also to citation(s) 32277, 32281

32312 (NIPER–684-Vol.1) **National Institute for Petroleum and Energy Research quarterly technical report for January 1–March 31, 1993: Volume 1, Fuels research.** National Inst. for Petroleum and Energy Research, Bartlesville, OK (United States). Aug 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-83FE60149. Order Number DE93019925. Source: OSTI; NTIS; GPO Dep.

Accomplishments for this past quarter are presented for the following tasks: Development of analytical methodology for analysis of heavy crudes; and thermochemistry and thermophysical properties of organic nitrogen and diheteroatom-containing compounds. Some of the highlights are: Catalytic cracking experiments on liquid chromatographic fractions from Maya (Mexico), Brass River (Nigeria) and Lagomedio (Venezuela) 650° F+ resids were completed; a series of blends of a conventional gas oil and a Wilmington 700–1000° F base fraction were also cracked in order to determine the degree of basic nitrogen poisoning of the catalyst as a function of base concentration; density measurements between approximately 320 K and 550 K were completed for 2-methylquinoline; heat-capacity and enthalpy measurements were completed for 2-methylquinoline; high-temperature heat-capacities and the critical temperature (near 800 K) for 2-methylquinoline were determined; and ebulliometric vapor pressures were measured for 2-methylquinoline.

32313 (NIPER–700-Vol.1) **National Institute for Petroleum and Energy Research quarterly technical report for April 1–June 30, 1993: Volume 1, Fuels research.** National Inst. for

Petroleum and Energy Research, Bartlesville, OK (United States). Aug 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-83FE60149. Order Number DE93019926. Source: OSTI; NTIS; GPO Dep.

Progress reports are presented for the following fuels researches: Development of analytical methodology for analysis of heave crudes; and thermochemistry and thermophysical properties of organic nitrogen and diheteroatom-containing compounds. Some of the accomplishments are: Topical reports summarizing GC/MS methodology for determination of amines in petroleum and catalytic cracking behavior of compound type in Wilmington 650° F+ resid were completed; density measurements between 320 K and 550 K were completed for 8-methylquinoline; high-temperature heat-capacities and critical temperature (near 800 K) for 8-methylquinoline were determined; vapor-pressure measurements were completed for 2,6-dimethylpyridine; and a series of enthalpy-of-combustion measurement was completed for 1,10-phenanthroline, phenazine, 2-methylquinoline, and 8-methylquinoline.

0250 Combustion

Refer also to citation(s) 33121, 33126

32314 (IFRF-F–99/y/1) **Characterization of semi-industrial scale fuel oil sprays issued from a Y-jet atomizer.** Sayre, A.N. (International Flame Research Foundation, IJmuiden (Netherlands)); Dugue, J.; Weber, R.; Domnick, J.; Lindenthal, A. International Flame Research Foundation, Ijmuiden (Netherlands). Jun 1993. 56p. Order Number DE93524748. Source: OSTI; NTIS; Also available from IFRF, P.O. Box 10000, 1970 CA IJmuiden (Netherlands).

Results on an experimental study of semi-industrial scale, isothermal, light and heavy fuel oil sprays. Non-intrusive optical techniques were employed to characterize the sprays at oil flow rates corresponding to a thermal input from 1.7 to 2.0 MW. Measurements of drop size and velocities were performed with a Phase Doppler particle analyzer (PDPA) for inlet spray conditions corresponding to combustion studies at MIT and IFRF. The measurements in light fuel oil (LFO) were globally more difficult than in heavy fuel oil (HFO) because of the significantly higher number density and noticeable multiple scattering effects. In the LFO sprays, the simultaneous presence in the measurement volume of many particles smaller than the detection limit led to noisy signals and at times low signal validation rates. In the HFO spray, the lower number density of much larger particles led to comparatively easy measurements with clean Doppler signal and high validation rates. a parametric investigation was performed to assess the influence of oil type, air flow rate, oil flow rate, oil temperature. It has been shown that the heavy fuel oil sprays exhibit a longer persistence of organized, non-homogeneous structures and a much coarser drop size. The average Arithmetic mean diameter 30 cm from the atomizer was typically 65% larger for HFO than for LFO. a laser imaging technique was also used for one spray condition to verify the PDPA measurements. The Sauter mean diameter measured with the PDPA was 13% higher than with the imaging technique, which can be considered a good agreement if we take into account the different measurement principles of these two techniques. Laser sheet visualization was applied to provide a qualitative characterization of the spray structure and to complement the quantitative measurements. These results were consistent with the PDPA measurements. 23 figs., 7 tabs., 14 refs.

03 NATURAL GAS

0302 Reserves, Geology, and Exploration

Refer also to citation(s) 32254

0303 Drilling, Production, and Processing

Refer also to citation(s) 32158, 32262, 32263, 32264, 32270, 32279, 32280, 32283, 32303, 32309, 32319, 33284

32315 (DOE/MC/28080–3381) **Ground movements associated with gas hydrate production: Progress report, July 1–September 30, 1992.** Siriwardane, H.J. West Virginia Univ., Morgantown, WV (United States). Coll. of Engineering. [1992]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG21-91MC28080. Order Number DE93019887. Source: OSTI; NTIS; GPO Dep.

The grantee will evaluate the influence of hydrate production on ground subsidence near the wellbore and the surface. The objective of this research will be achieved by using computer simulations of what is expected in a hydrate reservoir during the production stage as reported by hydrate production models and available data. The model will be based on theories of continuum mechanics, thermomechanics of hydrate production, principles of rock mechanics and geomechanics, and special features of geomaterials under cold temperatures such as those found in permafrost regions. The research work involved in the proposed investigation will be divided into three major tasks: (1) Mechanics of subsidence in permafrost regions; (2) modeling of subsidence; and (3) parametric studies. Progress reports are presented for tasks 1 and 2.

32316 (DOE/MC/28080–3382) **Ground movements associated with gas hydrate production: Progress report, January 1–March 31, 1993.** Siriwardane, H.J. West Virginia Univ., Morgantown, WV (United States). Coll. of Engineering. [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG21-91MC28080. Order Number DE93019888. Source: OSTI; NTIS; GPO Dep.

The grantee will evaluate the influence of hydrate production on ground subsidence near the wellbore and the surface. The objective of this research will be achieved by using computer simulations of what is expected in a hydrate reservoir during the production stage as reported by hydrate production models and available data. The model will be based on theories of continuum mechanics, thermomechnanics of hydrate production, principles of rock mechanics and geomechanics, and special features of geomaterials under cold temperatures such as those found in permafrost regions. The research work involved in the proposed investigation will be divided into three major tasks: mechanics of subsidence in permafrost regions; modeling of subsidence; and parametric studies. Under task 1, the literature survey was completed, and following factors were identified influencing subsidence: overburden depth; extent of dissociated (or depleted) hydrate reservoir; rock/frozen soil mechanical properties and strength; and reservoir compaction characteristics. Under task 2, technical progress is reported for studies on: mechanical properties; simulation of reservoir compression; and computer modeling effort.

32317 (SAND–93-7042) **Hydraulic fracture model comparison study: Complete results.** Warpinski, N.R. (Sandia National Labs., Albuquerque, NM (United States)); Abou-Sayed, I.S.; Moschovidis, Z.; Parker, C. Sandia National Labs., Albuquerque, NM (United States); Gas Research Inst., Chicago, IL (United States). Feb 1993. 174p. Sponsored by Gas Research Inst., Chicago, IL (United States). DOE Contract AC04-76DP00789. (GRI–93/0109). Order Number DE93018488. Source: OSTI; NTIS; GPO Dep.

Large quantities of natural gas exist in low permeability reservoirs throughout the US. Characteristics of these reservoirs, however, make production difficult and often economic and stimulation is required. Because of the diversity of application, hydraulic fracture design models must be able to account for widely varying rock properties, reservoir properties, in situ stresses, fracturing fluids, and proppant loads. As a result, fracture simulation has emerged as a highly complex endeavor that must be able to describe many different physical processes. The objective of this study was to develop a comparative study of hydraulic-fracture simulators in order to provide stimulation engineers with the necessary information to make rational decisions on the type of models most suited for their needs. This report compares the fracture modeling results of twelve different simulators, some of them run in different modes for eight separate design cases. Comparisons of length, width, height, net pressure, maximum width at the wellbore, average width at the wellbore, and average width in the fracture have been made, both for the final geometry and as a function of time. For the models in

this study, differences in fracture length, height and width are often greater than a factor of two. In addition, several comparisons of the same model with different options show a large variability in model output depending upon the options chosen. Two comparisons were made of the same model run by different companies; in both cases the agreement was good. 41 refs., 54 figs., 83 tabs.

32318 **Separation of ethane from methane by pressure swing absorption.** Maurer, R.T. To UOP (United States). 7 Nov 1992. Filed date 6 May 1991. Canada patent application 2041874. 18p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

A pressure swing adsorption (PSA) process is provided for methane purification that can yield a high purity product at higher recoveries than heretofore possible. The process includes the following steps: passing a feedstream containing ethane and methane at an upper adsorption pressure to an adsorption zone containing a zeolitic molecular sieve in which ethane is adsorbed, recovering an adsorption effluent stream enriched in methane relative to the feedstream; regenerating the adsorption zone by depressurizing the adsorption zone to a desorption pressure that is lower than the adsorption pressure, recovering a desorption effluent stream containing ethane; and repressurizing the adsorption zone to the adsorption pressure, returning to the first step. The molecular sieve used in the process of the invention is of the faujasite type having a framework silica/alumina molar ratio of from 2:1 and 100:1. It contains at least 20 equivalent % of a cation species selected from zinc, rare earth metal, hydrogen, ammonium, calcium or mixtures thereof, and not more than 80 equivalent % of an alkali or alkaline earth metal cation other than Ca or mixtures thereof. In another aspect of the invention, the PSA process involves passage of the feedstream to at least one of four adsorption zones. 2 figs.

0304 Products and By-Products

32319 (DOE/FTR–93017325) **Travel to Canada for the Natural Gas Conversion Conference for the purpose of exchanging information on technology advances and future challenges of natural gas conversion to fuels and chemicals: Foreign trip report, June 12, 1991–June 15, 1991.** Cinquegrane, G. USDOE Pittsburgh Energy Technology Center, PA (United States). 3 Jul 1991. 6p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93017325. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This first conference, sponsored by the CANMET's Energy Research Laboratories (ERL), focused attention on the use of natural gas as a feedstock in emerging direct conversion technologies for synthesis of added value products, i.e. liquid transportation fuels and chemicals. One of the technologies discussed was PETC's oxyhydrochlorination process for converting methane and other light hydrocarbons to liquid, gasoline-range hydrocarbons.

0306 Economic, Industrial, and Business Aspects

Refer also to citation(s) 32300, 33039

32320 (CONF-930495–) **Conference on natural gas use state regulation and market dynamics in the Post 636/Energy Policy Act Era: Proceedings.** USDOE, Washington, DC (United States). [1993]. 666p. Sponsored by USDOE, Washington, DC (United States). From DOE/NARUC national conference on natural gas use: state regulation and market dynamics in the post-636/Energy Policy Act, Era; New Orleans, LA (United States); 26-28 Apr 1993. Order Number DE93019185. Source: OSTI; NTIS; INIS; GPO Dep.

Reports in this Record of Proceedings explore a wide variety of issues related to the regulation of natural gas and its future role as one of the critical fuels that powers the economy of the United States. The focus is mainly on problems, obstacles, barriers, and the incredibly complex system created to bring a fuel from wellhead to burner tip. Individual papers have been cataloged separately.

32321 (DOE/EIA–0130(93/06)) **Natural gas monthly, June 1993.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 22 Jun 1993. 131p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93016282. Source: OSTI; NTIS; GPO; GPO Dep.

The Natural Gas Monthly (NGM) highlights activities, events, and analyses of interest to public and private sector organizations associated with the natural gas industry. Volume and price data are presented each month for natural gas production, distribution, consumption, and interstate pipeline activities. Producer related activities and underground storage data are also reported. From time to time, the NGM features articles designed to assist readers in using and interpreting natural gas information.

32322 (DOE/EIA–M052) **GASCAP: Wellhead Gas Productive Capacity Model documentation, June 1993.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. [1993]. 347p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93017833. Source: OSTI; NTIS; INIS; GPO Dep.

The Wellhead Gas Productive Capacity Model (GASCAP) has been developed by EIA to provide a historical analysis of the monthly productive capacity of natural gas at the wellhead and a projection of monthly capacity for 2 years into the future. The impact of drilling, oil and gas price assumptions, and demand on gas productive capacity are examined. Both gas-well gas and oil-well gas are included. Oil-well gas productive capacity is estimated separately and then combined with the gas-well gas productive capacity. This documentation report provides a general overview of the GASCAP Model, describes the underlying data base, provides technical descriptions of the component models, diagrams the system and subsystem flow, describes the equations, and provides definitions and sources of all variables used in the system. This documentation report is provided to enable users of EIA projections generated by GASCAP to understand the underlying procedures used and to replicate the models and solutions. This report should be of particular interest to those in the Congress, Federal and State agencies, industry, and the academic community, who are concerned with the future availability of natural gas.

0307 Waste Management

Refer also to citation(s) 32303

0308 Environmental Aspects

Refer also to citation(s) 32324, 33002

0310 Legislation and Regulations

Refer also to citation(s) 32320

0320 Transport, Handling, and Storage

Refer also to citation(s) 32309, 33411

32323 **Method of stopping the flow of natural gas.** Tozer, P. 4 Dec 1992. Filed date 3 Jun 1991. Canada patent application 2043778. 17p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

A device for stopping the flow of fluid under pressure from an open ended pipe includes clamp means adapted to grasp a pipe adjacent its open end. Stopper holder means extend from the clamp means and are alignable with the open end of the pipe. Stopper means, adapted to be held by the stopper holder means in a position aligned with the open end of the pipe are insertable from the aligned position into the pipe to stop the flow of fluid from the pipe. The invention is particularly applicable to stopping the uncontrolled escape of natural gas from pressure lines in emergencies when no valve is accessible, or the only accessible valve is broken or cannot otherwise be used. In tests from start to finish, it has been demonstrated that gas flows can be stopped within 10-15 seconds by a single individual using the device of the invention. 5 figs.

0340 Combustion

Refer also to citation(s) 33121, 33775

32324 (NEI-DK–1240) **Tests of gas-blast burners.** Lindhard, L.S.; Spiegelhauer, B. Dansk Gasteknisk Center A/S, Hoersholm (Denmark). Dec 1992. 55p. (In Danish). Order Number DE93516643. Source: OSTI; NTIS; INIS.

Testing of the most sold small gas-blast burners on the Danish market was carried out with regard to carbon monoxide emission contra the content of oxygen in the flue gas in relation to the burners' combustion stability at varying fire box pressures. The burners tested were Weishaupt WG 1: DG no. 2506, Riello 40 GS3: DG no. 2722, Bentone BEG 15: DG no. 2153 and Box 1 G: no. 1104. This covers 90% of the Danish market for gas burners. It was concluded that all the burners had a broader area of adjustment possibilities without carbon monoxide emission than previously tested box burners. This with the exception of when surplus oxygen is low, where large of amounts of carbon monoxide are generated at an oxygen content in flue gas of ca. 2% (10.8% CO_2). Burners in which the total pressure in the blower was high were the most stable with regard to air supply and varying fire-box pressure. It is pointed out that other conditions of design have also influence in this respect. In the cases of Weishaupt, Bentone and Riello burners there is a significant relation between blast pressure and oxygen content in the flue gas, whereas in the case of the Box burner, the percentage of oxygen in the flue gas rises in relation to increased pressure in the smoke outlet. The results of the tests are presented in great detail. (AB)

32325 (NEI-NO–350) **Heat transfer of finned tube bundles in crossflow with and without partial condensation.** Uv, E.H. Trondheim Univ. (Norway). Norges Tekniske Hoegskole. Dec 1992. 156p. Order Number DE93516704. Source: OSTI; NTIS.

The aim of the present work is to investigate heat transfer and pressure drop of highfinned tube bundles in cross flow with main attention to partial condensation heat transfer. Heat transfer and isothermal pressure drop measurements are performed in a seven row deep and two row high staggered circular finned tube bundle. Heat transfer is measured using a single calorimeter tube placed in a tube bundle of uncooled tubes. The applied tube geometry considers a tube diameter of 26.9 and 33.7 mm, a fin density of 157 and 197 m^1 and fin heights from 6 to 13.5 mm. The study covers a Reynolds number range from 10^4 to $5x10^4$ based on the base tube diameter and the velocity in the narrowest cross section. Moist air is used with free stream temperatures ranging from 50 to 100°C and vapour contents up to 15% by weight. Both embedded tension wound (commercial) and fully integral (ideal) finned tubes are used. Single phase heat transfer and pressure drop results are presented and compared to correlations from the literature. Dry and wet contact resistance of the commercial tubes is evaluated, and finally the results from the main experimental program considering partial condensation are presented. The applied data reduction model is more comprehensive than those commonly used in the literature. The heat transfer performance is affected by condensate retention which causes parts of the fin surface to be blocked out. Larger interfin spacings and high Reynolds numbers seem to prevent condensate retention. The heat transfer can then be calculated by means of the dry convective heat transfer coefficient and the analogy between convective heat and mass transfer. 75 refs., 63 figs., 16 tabs.

32326 (RISOe-R–703(EN)) **Measurements of temperatures, radiation and heat transfer in natural gas flames: Final report of the JIVE project.** Ott, S. Risoe National Lab., Roskilde (Denmark). Systems Analysis. Jul 1993. 59p. Contract STEP-CT90-098(DTEE). Order Number DE93525257. Source: OSTI; NTIS; Also available from Risoe Library, P.O. Box 49, DK-4000 Roskilde, Denmark.

A series of experiments were performed at Risoe's jet flame facility, where 5 MW natural gas flames can be produced (corresponding to a release rate of 0.13 kg/s). The flame was directed horizontally parallel to the average wind direction, and the gas release rate and the nozzle diameter were varied. Experiments with a free, unobstructed flame were performed in a variety of atmospheric conditions, and measurements of flame temperatures, heat radiation in the surroundings of the flame as well as infrared (IR) video recordings were made. Digital image processing was used to extract the flame length L, the width W and the buoyant lift H. The results show that L is determined by the rate of gas released, and no dependence on wind speed could be found in the data. In terms of Froude scaling L/D was found to be proportional to Fr^n, with n very close to 1/5. W/D and H/D were found to depend on both Fr and the ratio of the ambient wind speed and the gas exit velocity, but these two quantities are less well determined in these experiments. Flame temperatures were measured simultaneously at 64 positions by thermocouples arranged in an 8 by 8 square grid. The grid could be moved through the flame, in this way obtaining temperature time series from 512 points in space. The data analysis shows that the position of the centre of the flame is shifted by changes of the wind direction, and that a 90% correlation exists between wind direction fluctuations and flame centre meandering. Furthermore it was found, that the flame temperature data are consistent with a flame that has a fixed shape, but a moving centre. Heat transfer to a flat steel plate was also measured. Heat transfer rates of the order of 100 kW/m^2 were observed. (au) (28 tabs., 36 ills., 4 refs.)

32327 (UCRL-ID–112943) **Numerical simulation of turbulent mixing and combustion near the inlet of a burner.** Cloutman, L.D. Lawrence Livermore National Lab., CA (United States). Feb 1993. 27p. Sponsored by USDOE, Washington, DC (United States); California Inst. for Energy Efficiency, Berkeley, CA (United States). DOE Contract W-7405-ENG-48. Order Number DE93017960. Source: OSTI; NTIS; GPO Dep.

The COYOTE computer program was used to simulate the flow field and turbulent mixing near the fuel and air inlets in a simplified burner that was proposed for experimental study at the Combustion Laboratory at the University of California at Irvine. Four cases are presented, with and without chemical reactions, with two different outflow boundary conditions, and with two different swirl numbers. These preliminary results demonstrate the ability of COYOTE to simulate burners, and they illustrate some limitations and requirements of such modeling.

04 OIL SHALES AND TAR SANDS

0404 Oil Production, Recovery, and Refining

Refer also to citation(s) 32158, 32257

32328 (DOE/BC/14479–15) **Chemically assisted in situ recovery of oil shale: [Quarterly] report, April 1, 1993–June 30, 1993.** Ramirez, W.F. Colorado Univ., Boulder, CO (United States). Dept. of Chemical Engineering. [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89BC14479. Order Number DE93040005. Source: OSTI; NTIS; GPO Dep.

The objective of this work is to investigate, in the laboratory, the parameters associated with a chemically assisted in situ recovery procedure, using hydrogen chloride (HCl), carbon dioxide (CO_2), and steam (H_20), to obtain data useful to develop a process more economic than existing processes and to report all findings. The technical progress of the project is reported. The project status is that the progress is being made towards being able to run meaningful experiments.

32329 (DOE/MC/11076–3385) **Oil shale, tar sand, coal research, advanced exploratory process technology, jointly sponsored research: Quarterly technical progress report, April–June 1993.** Western Research Inst., Laramie, WY (United States). [1993]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-86MC11076. Order Number DE93019995. Source: OSTI; NTIS; GPO Dep.

Progress made in five areas of research is described briefly. The subtask in oil shale research is on oil shale process studies. For tar sand the subtask reported is on process development. Coal research includes the following subtasks: Coal combustion; integrated coal processing concepts; and solid waste management. Advanced exploratory process technology includes the following: Advanced process concepts; advanced mitigation concepts; oil and

gas technology. Jointly sponsored research includes: Organic and inorganic hazardous waste stabilization; CROW™ field demonstration with Bell Lumber and Pole; development and validation of a standard test method for sequential batch extraction fluid; operation and evaluation of the CO^2 HUFF-N-PUFF Process; fly ash binder for unsurfaced road aggregates; solid-state NMR analysis of Mesaverde Group, Greater Green River Basin, tight gas sands; characterization of petroleum residua; shallow oil production using horizontal wells with enhanced oil recovery techniques; surface process study for oil recovery using a thermal extraction process;NMR analysis of samples from the ocean drilling program; oil field waste cleanup using tank bottom recovery process; remote chemical sensor development; in situ treatment of manufactured gas plant contaminated soils demonstration program; solid-state NMR analysis of Mowry formation shale from different sedimentary basins; solid-state NMR analysis of naturally and artificially matured kerogens; and development of effective method for the clean-up of natural gas.

32330 (DOE/MC/11089–3388) **Pressurized Fluidized-Bed Hydroretorting of eastern oil shales: Final report, June 1992–January 1993.** Roberts, M.J. (Institute of Gas Technology, Chicago, IL (United States)); Mensinger, M.C.; Erekson, E.J.; Rue, D.M.; Lau, F.S.; Schultz, C.W.; Hatcher, W.E.; Parekh, B.K.; Bonner, W.P. Institute of Gas Technology, Chicago, IL (United States); Alabama Univ., University, AL (United States). Mineral Resources Inst.; Kentucky Univ., Lexington, KY (United States). Center for Applied Energy Research; Tennessee Technological Univ., Cookeville, TN (United States). Mar 1993. 204p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-87MC11089. Order Number DE93040362. Source: OSTI; NTIS; GPO Dep.

The Devonian oil shales of the Eastern United States are a significant domestic energy resource. The overall objective of the multi-year program, initiated in September 1987 by the US Department of Energy was to perform the research necessary to develop the pressurized fluidized-bed hydroretorting (PFH) process for producing oil from Eastern oil shales. The program also incorporates research on technologies in areas such as raw shale preparation, beneficiation, product separation and upgrading, and waste disposal that have the potential of improving the economics and/or environmental acceptability of recovering oil from oil shales using the PFH process. The program was divided into the following active tasks: Task 3 – Testing of Process Improvement Concepts; Task 4 – Beneficiation Research; Task 6 – Environmental Data and Mitigation Analyses; and Task 9 – Information Required for the National Environmental Policy Act. In order to accomplish all of the program objectives, tho Institute of Gas Technology (IGT), the prime contractor, worked with four other institutions: The University of Alabama/Mineral Resources Institute (MRI), the University of Alabama College of Engineering (UA), University of Kentucky Center for Applied Energy Research (UK-CAER), and Tennessee Technological University (TTU). This report presents the work performed by IGT from June 1, 1992 through January 31, 1993.

0405 Properties and Composition

Refer also to citation(s) 32312, 32313, 32329

32331 (DOE/MC/29240–3396) **Shale oil value enhancement research: First quarterly technical progress report, March 1, 1993–May 31, 1993.** Bunger, J.W.; Russell, C.P.; Devineni, P.A.V.; Cogswell, D.E.; Wiser, J.W. Bunger (James W.) and Associates, Inc., Salt Lake City, UT (United States). 25 Jun 1993. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-93MC29240. Order Number DE93040367. Source: OSTI; NTIS; GPO Dep.

Concurrent progress is being made in all key areas, namely, separation, characterization and market assessment. The market area, not one of our traditionally strong areas, has been going better than expected. We believe this is due mainly to the emerging interest in new and unconventional materials. The characterization work has been progressing solidly with the fundamental Z-BASIC correlations providing information not heretofore available in the chemical literature. Our agreement with Hewlett-Packard regarding the purchase of equipment at a reduced price is complete and the gc-ms will be ordered shortly. The separation work has progressed satisfactorily although an unexpected amount of time has been required for "facilities" and "equipment" related issues. Some of these issues have dealt with safety and regulatory compliance when storing larger quantities of samples. These now seem to be solved. We have a lot of direct experience in shale oil separations dating back to the OXY project and before. Also, we will streamline our work by going to prepacked micro-separation tools for some of our separation characterization work. This will allow us to stay on schedule. Overall, we are on schedule with the project. All administration requirements are in place and the accounting and financial records are current.

0407 Health and Safety

Refer also to citation(s) 33946

0408 Economic, Industrial, and Business Aspects

Refer also to citation(s) 32301

0409 Waste Management

Refer also to citation(s) 32330

05 NUCLEAR FUELS

0504 Feed Processing

Refer also to citation(s) 32567

32332 (RL-SEP–180) **Tentative U-233 and thorium nitrate specifications.** Tomlinson, R.E. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 18 Dec 1964. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93017366. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report discusses the review of the proposed thorium nitrate specifications,the preparation of tentative product specifications for Purex U-233 and thorium nitrates, and an estimation of the feasibility, cost and product composition for providing U-233 oxide at Hanford. The tentative specifications proposed for U-233 and thorium product for the Purex Plant are presented. The values chosen represent the understanding of feed material and reactor processing needs and the current estimates of Purex Plant capabilities.

0505 Uranium Enrichment

Refer also to citation(s) 32553

32333 (UCRL-CR–113821) **[Atomic Vapor Laser Isotope Separation (AVLIS) program]: Final report, [January–July 1992].** Lawrence Livermore National Lab., CA (United States); Talandic Research Corp., Irwindale, CA (United States). 4 Dec 1992. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93018001. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes work performed for the Atomic Vapor Laser Isotope Separation (AVLIS) program from January through July, 1992. Each of the tasks assigned during this period is described, and results are presented. Section I details work on sensitivity matrices for the UDS relay telescope. These matrices show which combination of mirror motions may be performed in order to effect certain changes in beam parameters. In Section II, an analysis is given of transmission through a clipping aperture on the launch telescope deformable mirror. Observed large transmission losses could not be simulated in the analysis. An EXCEL spreadsheet program designed for in situ analysis of UDS optical systems is described in Section III. This spreadsheet permits analysis of changes in beam first-order characteristics due to changes in any optical system parameter, simple optimization to predict mirror motions needed to effect a combination of changes in beam

parameters, and plotting of a variety of first-order data. Optical systems may be assembled directly from OSSD data. A CODE V nonsequential model of the UDS optical system is described in Section IV. This uses OSSD data to build the UDS model; mirror coordinates may thus be verified. Section V summarizes observations of relay telescope performance. Possible procedures which allow more accurate assessment of relay telescope performance are given.

32334 (UCRL-JC–114211) **Status of Uranium Atomic Vapor Laser Isotope Separation Program.** Chen, Hao-Lin; Feinberg, R.M. Lawrence Livermore National Lab., CA (United States). Jun 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930639–1: International conference on enrichment, Washington, DC (United States), 13-15 Jun 1993). Order Number DE93017971. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses demonstrations of plant-scale hardware embodying AVLIS technology which were completed in 1992. These demonstrations, designed to provide key economic and technical bases for plant deployment, produced significant quantities of low enriched uranium which could be used for civilian power reactor fuel. We are working with industry to address the integration of AVLIS into the fuel cycle. To prepare for deployment, a conceptual design and cost estimate for a uranium enrichment plant were also completed. The U-AVLIS technology is ready for commercialization.

32335 (Y/DD–608) **Validation of criticality safety calculational methods for U-AVLIS plant project.** Lewis, K.D. Oak Ridge Y-12 Plant, TN (United States). 14 Jul 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. (CONF-9309120–4: American Nuclear Society meeting, Nashville, TN (United States), 19-23 Sep 1993). Order Number DE93018590. Source: OSTI; NTIS; INIS; GPO Dep.

The objectives of the Uranium Atomic Vapor Laser isotope Separation (U-AVLIS) are to develop, demonstrate, and deploy a laser-based process to enrich natural uranium in the U-235 isotope to levels useful as fuel in commercial light-water power reactors. Current U-AVLIS production plant criteria call for uranium product enriched in ^{235}U up to 5 wt%. Development of the U-AVLIS technology is in an advanced stage, and demonstration of the integrated enrichment process is currently in progress using plant-scale equipment in the Uranium Demonstration System (UDS) at Lawrence Livermore National Laboratory. In this paper several existing experimental data which are applicable to the critical systems of importance to the safe design of the U-AVLIS plant are identified. These were used to benchmark a configuration-controlled, work station based version of one state-of-the-art computer code employed by the U-AVLIS program in UDS equipment design, and in U-AVLIS plant conceptual design NCS analyses.

0507 Fuels Production and Properties

Refer also to citation(s) 32332, 32334, 32830, 32833, 32835, 32836, 32837, 32838, 32839, 32840, 32841, 32842, 32843, 32844, 32846, 32847, 32848, 32849, 32850, 32851, 32852, 32853, 32854, 32855, 32856, 32857, 32858, 32859, 32860, 32861, 32862, 32863, 32864, 32865, 32866, 32867, 32868, 32869, 32870, 32871, 32872, 32873, 32874, 32875, 32876, 32877, 32878, 32879, 32880, 32881, 32882, 32883, 32884, 32885, 32886, 32887, 32888, 32889, 32890, 32891, 32894, 32895, 33180, 33296, 33331, 33733, 33792

32336 (INIS-mf–13548, pp. 49-55) **Generalized diagram of gas fission products release mechanisms from irradiated uranium dioxide.** Samsonov, B.V. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (Russian Federation)); Gremyachkin, V.A. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 9.* 225p. Order Number DE94600002. Source: OSTI; NTIS (US Sales Only); INIS.

Basic experimental data on gas fission products release from irradiated uranium dioxide at different temperatures and specific fission densities are generalized. New data on gas fission products release from powdery UO_2 within the temperature 1000 K are presented. Generalized diagram of gas fission products release is derived as a function of temperature fission density and average fuel density dividing the regions of release as a result of recoil, thermally activated and radiation stimulated diffusion. The effect of void-traps on diffusive release with capturing atoms of gas fission products and removing them from the atom-per-atom diffusion process is shown. The region of thermally activated diffusion of gas-filled bubbles is given. 9 refs.; 2 figs. (author).

32337 (INIS-mf–13548, pp. 63-76) **Regularity of radiation behaviour of uranium dioxide with a limited structure.** Gridnev, A.A. (Podol'skij Nauchno-Issledovatel'skij Tekhnologicheskij Institut, Podol'sk (Russian Federation)). AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 9.* 225p. Order Number DE94600002. Source: OSTI; NTIS (US Sales Only); INIS.

Radiation behaviour of UO_2 with limited structure (when the open porosity is less than limited value and is not sensible to the temperature regime of irradiation) was studied. This permitted to consider in details the mechanisms of swelling and gas emission in fuel elements. 11 refs.; 5 tabs.

0508 Spent Fuels Reprocessing

Refer also to citation(s) 32419, 32588, 32780, 33287

32338 (DOE/FTR–93019182) **Fact finding trip to Russia concerning the April 6, 1993 chemical explosion at the Siberian Chemical Combine in order to support a safety review of US facilities: Foreign trip report, June 18–29, 1993.** Wodrich, D.D. Westinghouse Hanford Co., Richland, WA (United States). 27 Jul 1993. 11p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93019182. Source: OSTI; NTIS (US Sales Only); GPO Dep.

On April 6, 1993, at the fuel reprocessing ("radiochemical") plant of the Siberian Chemical Combine in Tomsk-7, Russia, a sequence of events occurred that caused substantial physical damage to the facility. Because the Tomsk-7 facility utilized the PUREX process, similar to that used at US facilities, the US Department of Energy (DOE) has undertaken an effort to learn the details of this accident and its causes. The building roof has been replaced and most of the wall has been reconstructed. The plant is expected to be physically ready for operation in July 1993. Actions have been identified to prevent this type of accident in the future, and an independent safety group must be satisfied before the plant can be restarted. The US team has visited both MINATOM and the Tomsk-7 facilities is an effort to determine information that would support the safety reviews of similar reprocessing facilities in the US Both of the meetings were productive in achieving this objective. The US delegation also provided information on similar US chemical processing accidents. We believe that continued interchanges of information related to chemical nuclear facility safety in the future would be mutually beneficial to the US and Russian programs.

32339 (DPST–84-385) **Analysis of technetium in SRP uranium product streams.** Orebaugh, E.G. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Plant. 6 Apr 1984. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93019831. Source: OSTI; NTIS; GPO Dep.

Technetium (Tc) is a major fission product with a fission yield similar to ^{90}Sr and ^{137}Cs. All traces of the natural element have disappeared due to decay over the earth's history. The major isotope present in cooled nuclear fuel is ^{99}Tc with a half life of 2.12×10^5 years. This isotope decays via low energy (0.292 Mev) beta emission which is easily absorbed and contributes little penetrating radiation hazards in fuel reprocessing. Because it is difficult to detect, the distribution of ^{99}Tc in the F and H area process streams is

not generally well known. Previous studies have shown that a significant fraction of Tc follows uranium through the solvent extraction process. This study was conducted to analyze the ^{99}Tc content of SRP uranium product streams, to assess any hazard due to ^{99}Tc and to evaluate the impact of future higher burnup fuels on ^{99}Tc levels in uranium products. This summary report presents ^{99}Tc assays in uranium streams in F and H areas, relates these concentrations to solvent extraction conditions in the two areas, and compares the incremental radioactivity from ^{99}Tc in the product streams to the uranium itself. Presently the radioactivity contributed by ^{99}Tc is small relative to uranium. The proposed production using Mark 15 assemblies will also result in negligible increase in radioactivity due to ^{99}Tc.

32340 (EGG-M–93267) **Neutronics and fuel behavior of AIROX-processed fuel recycled into light water reactors.** Allison, C.M.; Jahshan, S.N.; Wade, N.L. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-930913–17: Global '93: future nuclear systems - emerging fuel cycles and waste disposal options, Seattle, WA (United States), 12-17 Sep 1993). Order Number DE93018944. Source: OSTI; NTIS; INIS; GPO Dep.

An evaluation of the Atomics International Reduction Oxidation (AIROX) process has begun to determine if the process could be used to recycle spent fuel to minimize high-level waste from commercial power reactors. This paper includes an evaluation of core neutronics to establish enrichment levels and expected in-reactor performance: a review of existing fuel behavior research to determine its applicability to AIROX-recycled fuels; and an evaluation of potential licensing issues unique to these fuels.

32341 (INIS-GB–493) **Statement of nuclear incidents at nuclear installations: fourth quarter 1992.** Health and Safety Executive, London (United Kingdom). 31 Mar 1993. 3p. Order Number DE94600065. Source: OSTI; NTIS (US Sales Only); INIS.

One incident was reported - at the Atomic Energy Authority Centre at Dounreay where there was a small leak of radioactive liquor. As a result, two operators suffered minor contamination of their hand and clothing and had to be decontaminated. Minor radioactive doses (well below the dose limits) were received by the employees who were decontaminated. Modifications to prevent a similar accident have been carried out. (UK).

32342 (RL-SEP–855) **Historical events of the Chemical Processing Department.** Lane, W.A. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 12 Nov 1965. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93017473. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of this report is to summarize and document the significant historical events pertinent to the operation of the Chemical Processing facilities at Hanford. The report covers, in chronological order, the major construction activities and historical events from 1944 to September, 1965. Also included are the production records achieved and a history of the department's unit cost performance.

0509 Transport, Handling, and Storage

Refer also to citation(s) 32397, 32577, 32582, 33117, 33352, 33378, 33389, 33390

32343 (DOE/WIPP–91-027C) **The WIPP institutional program for states' involvement in WIPP transportation planning, and operations.** Leonard, R. Westinghouse Electric Corp., Carlsbad, NM (United States). [1991]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-86AL31950. (CONF-911107–84: 1991 winter meeting of the American Nuclear Society (ANS), San Francisco, CA (United States), 10-15 Nov 1991). Order Number DE93017908. Source: OSTI; NTIS; INIS; GPO Dep.

The Supplemental Stipulated Agreement of 1982 between the state of New Mexico and the Department of Energy (DOE) committed the DOE to emergency response training in New Mexico. In 1988, the state of New Mexico and the DOE entered into a two-year agreement providing $203,017 for financial assistance and $67,000 for equipment to enhance the state's emergency response capability. In 1990, this agreement was extended for an additional two years providing $226,088 for financial assistance and $39,000 for emergency response equipment. Also, in 1988 an agreement between the Western Governors' Association and the United States Department of Transportation provided $1.0 million to seven western states (Colorado, Idaho, New Mexico, Oregon, Utah, Washington, and Wyoming) to identify and implement programs to help ensure the safe transportation of transuranic waste from western points of origin to the Waste Isolation Pilot Plant (WIPP). As part of this process, the Western Governors' Association and the seven states prepared the Report to Congress, Transport of Transuranic Wastes to the Waste Isolation Pilot Plant: State Concerns and Proposed Solutions. In July 1990, a five-year cooperative agreement between the Western Governors' Association and the DOE was signed providing $1.515 million in funding to seven states along the Hanford/WIPP route. This continued the work started under the Department of Transportation's cooperative agreement.

32344 (LA-SUB–93-250) **Motor carrier safety evaluation conducted at University of California, Los Alamos National Laboratory (UC/LANL), Los Alamos, NM.** Garrison, R.F. (RFG Associates, Inc., Gaithersburg, MD (US)). Los Alamos National Lab., NM (United States); RFG Associates, Inc., Gaithersburg, MD (United States). Nov 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93019306. Source: OSTI; NTIS; GPO Dep.

The U.S. Department of Transportation Federal Highway Administration (DOT) conducts motor carrier safety evaluations for the purpose of determining a motor carrier's safety fitness rating. Because it was believed that DOT or the State of New Mexico may not recognize UC/LANL exempt status and desire to inspect its transportation system and evaluate compliance with applicable laws and regulations, the lab contracted Garrison Associates to conduct a simulated motor carrier safety evaluation. This report enumerates the goals of this evaluation relevant to the Hazardous Materials Transportation Uniform Safety Act (HMTUSA) of 1990. The report describes the methodology of the evaluation and lists observations in order of importance.

32345 (ORNL/FTR–4635) **Travel to Austria to participate in the International Atomic Energy Agency's Consultants Services Meeting on Low Specific Activity Materials and for the revision of the IAEA Regulations for the Safe Transport of Radioactive Material: Foreign trip report, May 3–22, 1993.** Rawl, R.R. Oak Ridge National Lab., TN (United States). 7 Jun 1993. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93015467. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report discusses travel to participate in two IAEA-sponsored meetings. The Consultants Services Meeting on Low Specific Activity Materials (CS-23) was convened to further develop innovative approaches to classify and set material and packaging requirements for Low Specific Activity material and Surface Contaminated Objects (LSA/SCO). This was the third consultants services meeting to consider how basic problems with the LSA/SCO categories could be resolved. The Technical Committee Meeting on the Revision of the IAEA Regulations for the Safe Transport of Radioactive Material (TCM-405.3) was convened to make further progress in preparing the 1996 revision of Safety Series No. 6 (SS No. 6). A number of amendments to SS No. 6 have been proposed; the TCM had to consider these, make decisions as to whether or not to include them in SS No. 6 and the supporting documents (Safety Series Nos. 7, and 37), and draft the way in which they will be incorporated. The results of the TCM will be used to compile the first draft of SS No. 6 which will be circulated to Member States for comment.

32346 (ORNL/FTR–4636) **Travel to Austria to participate in meeting for revision of IAEA regulations for safe transport of radioactive material: Foreign trip report, May 15–22, 1993.** Parks, C.V. Oak Ridge National Lab., TN (United States). 7 Jun 1993. 108p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93015468. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The traveler participated in the Second Technical Committee Meeting (TCM-405.3) for the Revision of the IAEA Regulations for the Safe Transport of Radioactive Material as embodied in Safety Series No. 6 (SS6). Approximately 70 persons representing 21 countries and 7 international organizations attended TCM-405.3. The aim of this second of four planned Revision Panel Meetings was to direct the Secretariat on the preparation of the first draft of the 1996 Edition of SS6. The terms of reference for the meeting were gathered from proposed amendments and identified problems submitted by Member States and recommendations from recent IAEA-sponsored advisory group and consultant services meetings. The proposals and recommendations were referred to four "standing working groups (WG) and three ad hoc working groups for their consideration and decision. The standing WGs were Radiation Protection, Operational and Administrative Matters, Packaging Matters, and Criticality Safety. The traveler was Secretary for the Criticality Safety Working Group. Ad hoc WGs on UF_6, issues, Type C (new air shipment) packages, and reprocessed uranium issues were formed by the Revision Panel Chairman. Approximately 150 issues were addressed by the standing WGs, and WG reports (with separate decision sheets on each item) were prepared for review by the entire TCM. The ad hoc groups prepared similar reports addressing the specific issues provided by the Chairman and Scientific Secretary.

32347 (ORNL/FTR–4655) **Travel to England for conference on nuclear transport systems: Foreign trip report, June 7–10, 1993.** Shappert, L.B. Oak Ridge National Lab., TN (United States). 28 Jun 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93017236. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report discuss travel to England to attend an international 2-day conference on nuclear transport systems. In addition, the traveler participated in a 2-day meeting sponsored by the International Standards Organization, whose working group is developing a standard entitled "Trunnions for Spent Fuel Element Transport Packages." The standard had previously been submitted for ballot to member countries, and the United States cast the only negative vote. The US position was discussed, and revision to the standard was initiated.

32348 Fail-safe storage rack for fuel rod assemblies. Lewis, D.R. To Dept. of Energy. 1991. USA patent application 7-744,746. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC11-76PN00014. Order Number DE93019336. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses a fail-safe storage rack which is provided for interim storage of spent but radioactive nuclear fuel rod assemblies. The rack consists of a checkerboard array of substantially square, elongate receiving tubes fully enclosed by a double walled container, the outer wall of which is imperforate for liquid containment and the inner wall of which is provided with perforations for admitting moderator liquid flow to the elongate receiving tubes, the liquid serving to take up waste heat from the stored nuclear assemblies and dissipate same to the ambient liquid reservoir. A perforated cover sealing the rack facilitates cooling liquid entry and dissipation.

32349 (SAND–93-0135C) **Optimization of the Spent Fuel Attribute Tester using radiation transport calculations.** Laub, T.W. (Sandia National Labs., Albuquerque, NM (United States)); Dupree, S.A.; Arlt, R. Sandia National Labs., Albuquerque, NM (United States). [1993]. 7p. Sponsored by Department of State, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930749–11: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93017892. Source: OSTI; NTIS; INIS; GPO Dep.

The International Atomic Energy Agency uses the Spent Fuel Attribute Tester (SFAT) to measure gamma signatures from fuel assemblies stored in spent fuel pools. It consists of a shielded, collimated NaI(Tl) detector attached to an air-filled pipe. The purpose of the present study was to define design changes, within operational constraints, that would improve the target assembly ^{137}Cs signal relative to the background signals from adjacent assemblies. This improvement is essential to reducing to an acceptable level the measurement time during an inspection. Monte Carlo calculations of the entire geometry were impractical, therefore, a hybrid method was developed that combined one-dimensional discrete ordinates models of the spent fuel pool, three-dimensional Monte Carlo calculations of the SFAT, and detector response calculations. The method compared well with measurements taken with the existing baseline SFAT. Calculations predicted significant improvements in signal-to-noise ratio. Recommended changes included shortening the pipe and increasing its wall thickness, placing low-Z filters in the crystal line of sight, reducing the thickness of shielding around the collimator aperture and adding shielding around the crystal, and reducing the diameter of the crystal. An instrument incorporating these design changes is being fabricated in Finland and will be tested this year.

32350 (SR/H–592) **[TRU waste storage, transfer conveyor vendor contract, September 28, 1976–January 28, 1977].** [Engineering Department Project Files]. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Engineering Dept. [1977]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. Order Number DE93016189. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Engineering drawings for this project are identified as CAPE-3059. Inquiries may be directed to: Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831 (United States).

This report is a compilation of notes taken during the design and construction of radioactive waste handling systems at a Du Pont-managed facility.

32351 (UCRL-JC–113529) **A method for assessing the effect of sprinkler water on the reactivity of storage arrays of fissile material.** Lutz, H.F.; Sheaffer, M.K. Lawrence Livermore National Lab., CA (United States). May 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930907–7: ANS topical meeting on physics and methods in criticality safety, Nashville, TN (United States), 19-23 Sep 1993). Order Number DE93016993. Source: OSTI; NTIS; INIS; GPO Dep.

A model is developed that performs screening calculations to assess the reactivity added by sprinkler water in an air-spaced, storage array of fissile material that is surrounded by a water reflector. The purpose of the model is the expand the type of guidance given in ANSI/ANS-8.7, "Guide for Nuclear Criticality Safety in the Storage of Fissile Materials." The dimensions and densities of the storage vault with sprinkler water are changed with the constant optical thickness transformation to an equivalent system with water at a density of 1 g/cc surrounded by a superdense reflector. The validity of the model is demonstrated by comparison with Monte Carlo calculations made with KENO V.a on storage arrays of 93.2 wt % ^{235}U metal.

0510 Economic, Industrial, and Business Aspects

Refer also to citation(s) 32364

0520 Waste Management

Refer also to citation(s) 32340, 32342, 32343, 32530, 32532, 32534, 32542, 32545, 32547, 32548, 32549, 32555, 32562, 32568, 32569, 32575, 32578, 32616, 32797, 32801, 32812, 32818, 32824, 32913, 32954, 33061, 33287, 33309, 33311, 33337, 33742, 33794, 33801, 33817, 33820, 33853, 34653, 34654, 34655, 34656

32352 (AEA-D and R–0054) **Sorption on inactive repository components.** Gardiner, M.P.; Smith, A.J.; Williams, S.J. AEA Decommissioning and Radwaste, Harwell (United Kingdom). Jul 1990. 37p. Sponsored by Department of the Environment, London (United Kingdom). Her Majesty's Inspectorate of Pollution. Contract PECD-7/9/454;AI/CF/839;Project TD-4/68/72. (DOE-HMIP-RR–90.084.). Order Number DE94600310. Source: OSTI; NTIS (US Sales Only); INIS.

The near-field of an intermediate level/low level radioactive waste repository will contain significant quantities of iron and steel,

Magnox and Zircaloy. Their corrosion products may possess significant sorption capacity for radioelements. The sorption of americium and plutonium onto magnesium hydroxide, zirconium hydroxide, colloidal magnetite and colloidal haematite has been studied under conditions typical of the porewater of a cementitious near-field. R_D values $\geq 10^5$ ml g^{-1} were measured for both actinides on the oxides and hydroxides. These values are at least as great at those measured on crushed 3:1 Blast Furnace Slag/Ordinary Portland Cement. Competitive sorption experiments have shown that sorption onto the corrosion products does not take place in preference to that on the cement or the converse. Magnetite and haematite colloids are positively charged in cement-equilibrated water whilst zirconium hydroxide is negatively charged. Crushed cement was found to be positively charged. Simple experiments show that only a small proportion of haematite colloids is potentially mobile through a column of crushed cement. (author).

32353 (AEA-D and R–0077) **Removal of active species from liquid effluent: Annual progress report 1990.** Blake, N.J.; Ritchie, S.; Robinson, K.S. AEA Decommissioning and Radwaste, Harwell (United Kingdom). Aug 1990. 34p. Sponsored by Department of the Environment, London (United Kingdom). Her Majesty's Inspectorate of Pollution. Contract DOE-AI/CG/225. Order Number DE94600306. Source: OSTI; NTIS (US Sales Only); INIS.

The extraction and stripping of a strontium feed solution at 1000ppm and pH 7 has been investigated using a recirculating liquid membrane system. Feed solution was circulated through the tube-side of a hollow fibre unit, contacting an extractant solution of 20% v/v di-(2-ethylhexyl) phosphate in odourless kerosine at the inner wall. The partition coefficient for this extraction was 56000. The extractant was then pumped to the shell-side of a second hollow fibre unit, containing the strip solution of nitric acid in the tube-side of the fibres. Strontium removal from the feed solution was virtually complete after one hour, but the stripping time scale was at least an order or magnitude longer. Flowrates of each phase did not appear to affect the overall mass transfer coefficients for extraction or stripping operations. The extraction coefficient based on the feed phase was estimated to be 3.9×10^{-6}m s^{-1}. Stripping coefficients based on the strip phase were measured at 1.6×10^{-9} and 2.2×10^{-9}m s^{-1} for strip solutions of 0.1M and 1.0M nitric acid. These values compare reasonably well with published correlations. (author).

32354 (ANL/CHM/CP–79536) **Chemical mechanisms for gas generation in Tank 241-SY-101.** Strachan, D.M. (Pacific Northwest Lab., Richland, WA (United States)); Pederson, L.R.; Bryan, S.A.; Ashby, E.C.; Liotta, C.; Barefield, E.K.; Meisel, D.; Jonah, C.D.; Sauer, M.C. Jr. Argonne National Lab., IL (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920815–25: 204. American Chemical Society (ACS) national meeting, Washington, DC (United States), 23-28 Aug 1992). Order Number DE93019000. Source: OSTI; NTIS; GPO Dep.

The mixing of wastes at Hanford over the years has led to several safety concerns. These safety concerns fall into six categories: wastes that generate flammable gasses or gas mixtures; wastes that contain high concentrations of ferrocyanides or tanks suspected of containing large amounts of ferrocyanides; wastes that contain greater than 3 wt % total organic carbon; wastes from which toxic or noxious vapors are suspected of emanating; wastes that contain high radiolytic heat; and wastes that may contain sufficient fissile material to pose a criticality concern. This report addresses the chemistry associated with the generation of flammable gases.

32355 (ANL/EWM/CP–80486) **Requirements for shipment of DOE radioactive mixed waste.** Gablin, K.; No, Hyo; Herman, J. Argonne National Lab., IL (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930873–22: 2. international mixed waste symposium, Baltimore, MD (United States), 17-20 Aug 1993). Order Number DE93019019. Source: OSTI; NTIS; INIS; GPO Dep.

There are several sources of radioactive mixed waste (RMW) at Argonne National Laboratory which, in the past, were collected at waste tanks and/or sludge tanks. They were eventually pumped out by special pumps and processed in an evaporator located in the waste operations area in Building No. 306. Some of this radioactive mixed waste represents pure elementary mercury. These cleaning tanks must be manually cleaned up because the RMW material was too dense to pump with the equipment in use. The four tanks being discussed in this report are located in Building No. 306. They are the Acid Waste Tank, IMOX/FLOC Tanks, Evaporation Feed Tanks, and Waste Storage Tanks. All of these tanks are characterized and handled separately. This paper discusses the process and the requirements for characterization and the associated paperwork for Argonne Waste to be shipped to Westinghouse Hanford Company for storage.

32356 (ANL/FC/CP–77558) **Characterization of mixed CH-TRU waste at Argonne-West: A WIPP project update.** Dwight, C.C. (Argonne National Lab., Idaho Falls, ID (United States)); Guay, K.P.; Courtney, J.C.; Connolly, M.J.; Higgins, P.J. Argonne National Lab., Idaho Falls, ID (United States). 29 Jan 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38 ;FG02-89ER12896. (CONF-930205–79: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 mar 1993). Order Number DE93017444. Source: OSTI; NTIS; INIS; GPO Dep.

Argonne National Laboratory is participating in the Department of Energy's Waste Isolation Pilot Plant (WIPP) Experimental Test Program by characterizing and repackaging mixed contact-handled transuranic waste. Argonne's initial activities in the Program were described last year at Waste Management '92. Since then, additional waste has been characterized and repackaged, resulting in six bins ready for shipment to WIPP upon the initiation of the bin tests. Lessons learned from these operations are being factored in the design and installation of a new characterization facility, the Enhanced Waste Characterization Facility (EWCF). The objectives of the WIPP Experimental Test Program have also undergone change since last year leading to an accelerated effort to factor sludge sampling capability into the EWCF. Consequently, the initiation of non-sludge operations in the waste characterization chamber has been delayed to Summer 1993 while the sludge sampling modifications are incorporated into the facility. Benefits in operational flexibility, effectiveness, and efficiency and reductions in potential facility and personnel contamination and exposure are expected from the enhanced waste characterization facility within the Hot Fuel Examination Facility at Argonne-West. This paper summarizes results and lessons learned from recent characterization and repackaging efforts and future plans for characterization. It also describes design features and status of the EWCF.

32357 (BNL–48750) **Polymers for subterranean containment barriers for underground storage tanks (USTs): Letter report on FY 1992 activities.** Heiser, J.H.; Colombo, P.; Clinton, J. Brookhaven National Lab., Upton, NY (United States). Dec 1992. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE93019470. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) set up the Underground Storage Tank Integrated Demonstration Program (USTID) to demonstrate technologies for the retrieval and treatment of tank waste, and closure of underground storage tanks (USTs). There are more than 250 underground storage tanks throughout the DOE complex. These tanks contain a wide variety of wastes including high level, low level, transuranic, mixed and hazardous wastes. Many of the tanks have performed beyond the designed lifetime resulting in leakage and contamination of the local geologic media and groundwater. To mitigate this problem it has been proposed that an interim subterranean containment barrier be placed around the tanks. This would minimize or prevent future contamination of soil and groundwater in the event that further tank leakages occur before or during remediation. Use of interim subterranean barriers can also provide sufficient time to evaluate and select appropriate remediation alternatives. The DOE Hanford site was chosen as the demonstration site for containment barrier technologies. A panel of experts for the USTID was convened in February, 1992, to identify technologies for placement of subterranean barriers. The selection was based on the ability of candidate grouts to withstand high radiation doses, high temperatures and aggressive tank waste

leachates. The group identified and ranked nine grouting technologies that have potential to place vertical barriers and five for horizontal barriers around the tank. The panel also endorsed placement technologies that require minimal excavation of soil surrounding the tanks.

32358 (BNL–49295) **Elimination of weapons grade plutonium via burning in a Particle Bed Reactor.** Powell, J.R.; Ludewig, H.; Maise, G.; Todosow, M. Brookhaven National Lab., Upton, NY (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-930913–16: Global '93: future nuclear systems - emerging fuel cycles and waste disposal options, Seattle, WA (United States), 12-17 Sep 1993). Order Number DE93018824. Source: OSTI; NTIS; GPO Dep.

An initial assessment of a concept for burning weapons grade plutonium based on the Particle Bed Reactor (PBR) is described. The high power density/flux level achievable with the PBR make it an attractive candidate for this application. The PBR based plutonium burner concept also possesses a number of safety and economic benefits relative to other reactor based Pu-burner approaches including a safeguards advantages, a low inventory of radionuclides, and high integrity, coated fuel particles which can withstand extremely high temperatures while retaining virtually all fission products. In addition the reactor also possesses a number of "engineered safety features," which, along with the use of high temperature capable materials further enhance its safety characteristics.

32359 (CONF-8910364–Vol.2) **Transuranic waste technology development International Technology Exchange Program: Volume 2, Appendices: Final trip report, October 17–20, 1989.** USDOE, Washington, DC (United States); Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan). 1989. 567p. Sponsored by USDOE, Washington, DC (United States). (CONF-8903283–Summ.: Transuranic waste technology development international technology exchange program conference; 1. U.S. Department of Energy (DOE)/Power Reactor and Nuclear Fuel Development Corporation of Japan (PNC) bilateral coordination meeting on Order Number DE93016513. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Volume two contains the following appendices: bilateral agreement coordination meeting minutes; US participants' presentations; Japanese participants' presentations; and supplemental technical materials provided during exchange.

32360 (CONF-930572–10) **Uranium effluent testing for the Oak Ridge Toxic Substances Control Act mixed waste incinerator.** Shor, J.T. (Oak Ridge National Lab., TN (United States)); Bostick, W.D.; Hoffmann, D.P.; Gibson, L.V. Jr.; Ho, T.C. Oak Ridge National Lab., TN (United States). [1993]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 12. annual international symposium on thermal treatment technologies - incineration conference; Knoxville, TN (United States); 3-7 May 1993. Order Number DE93017861. Source: OSTI; NTIS; INIS; GPO Dep.

The Oak Ridge K-25 Site Toxic Substances Control Act (TSCA) Incinerator has been undergoing a series of routine tests to determine uranium partitioning to the stack, scrubber waters, and bottom ash. This paper discusses the results of the most recent experiment in which relatively high rates of uranium stack gas emissions were identified: 6.11 g/h or 8 wt % based on the uranium feed. These data are compared with earlier data, and an empirical correlation is suggested between the stack emissions of uranium and the product of the uranium and chlorine concentration of the feed. This is consistent with certain findings with other metals, in which increasing chlorine feed contents led to increasing emissions.

32361 (DOE/EA–0855) **Environmental Assessment for the sale of excess lithium hydroxide stored at the Oak Ridge K-25 Site and the Portsmouth Gaseous Diffusion Plant.** USDOE Oak Ridge Operations Office, TN (United States); USDOE Assistant Secretary for Defense Programs, Washington, DC (United States). Apr 1993. 81p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93016652. Source: OSTI; NTIS; GPO Dep.

The Department of Energy (DOE) has prepared an Environmental Assessment (EA) (DOE/EA-0855) for a competitive bid market sale of 80 million pounds of government surplus lithium hydroxide monohydrate (LiOH). The LiOH is no longer required for federal activities but is worth tens of millions of dollars in the commercial market. The purpose of the sale is to limit potential environmental liabilities associated with the storage of large quantities of LiOH, free critically needed storage space, reduce storage and maintenance costs currently estimated at $1M/year, and generate revenue for the Federal government. Based on the analysis in the EA, DOE has determined that the proposed action is not a major Federal action significantly affecting the quality of the human environment within the definition of the National Environmental Policy Act (NEPA) of 1969. Therefore, the preparation of an environmental impact statement is not required.

32362 (DOE/EH–0330) **Environment, Environmental Restoration, and Waste Management Field Organization Directory.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). RCRA/CERCLA Div. Jul 1993. 153p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93019893. Source: OSTI; NTIS; INIS; GPO Dep.

This directory was developed by the Office of Environmental Guidance, RCRA/CERCLA Division (EH-231) from an outgrowth of the Departments efforts to identify and establish the regulatory response lead persons in the Field Organizations. The directory was developed for internal EH-231 use to identify both the DOE and DOE contractor Field Organizations in the Environment, Environmental Restoration and Waste Management areas. The Field Organization directory is divided into three substantive sections: (1) Environment; (2) Environmental Restoration; and (3) Waste Management which are organized to correspond to the management hierarchy at each Field Organization. The information provided includes the facility name and address, individual managers name, and telephone/fax numbers.

32363 (DOE/EH–0333) **Management of hazardous waste containers and container storage areas under the Resource Conservation and Recovery Act.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). RCRA/CERCLA Div. Aug 1993. 157p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93019210. Source: OSTI; NTIS; INIS; GPO Dep.

DOE's Office of Environmental Guidance, RCRA/CERCLA Division, has prepared this guidance document to assist waste management personnel in complying with the numerous and complex regulatory requirements associated with RCRA hazardous waste and radioactive mixed waste containers and container management areas. This document is designed using a systematic graphic approach that features detailed, step-by-step guidance and extensive references to additional relevant guidance materials. Diagrams, flowcharts, reference, and overview graphics accompany the narrative descriptions to illustrate and highlight the topics being discussed. Step-by-step narrative is accompanied by flowchart graphics in an easy-to-follow, "roadmap" format.

32364 (DOE/EM–0096) **Summary of expenditures of rebates from the low-level radioactive waste surcharge escrow account for calendar year 1992.** USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). Jun 1993. 18p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93018386. Source: OSTI; NTIS; INIS; GPO Dep.

Report to Congress in response to public law 99-240.

This is the seventh report submitted to Congress in accordance with section 5(d)(2)(E)(ii)(II) of Title I–Low-Level Radioactive Waste Policy Amendments Act of 1985 (the Act). This section of the Act directs the Department of Energy (DOE) to summarize the annual expenditures of funds disbursed from the DOE surcharge escrow account and to assess compliance of these expenditures with the limitations specified in the Act. In addition to placing limitations on the use of these funds, the Act also requires the nonsited compact regions and nonmember States to provide DOE with an itemized report of their expenditures on December 31 of each year in which funds are expended. Within 6 months after receiving the individual

reports, the Act requires the Secretary to furnish Congress with a summary of the reported expenditures and an assessment of compliance with the specified usage limitations. This report fulfills that requirement. DOE disbursed funds totaling $15,037,778.91 to the States and compact regions following the July 1, 198[illegible] January 1, 1988, and January 1, 1990, milestones specified [illegible] Act. Of this amount, $1,445,701.61 was expended during calendar year 1992 and $10,026,763.87 was expended during the prior 6 years. At the end of December 1992, $3,565,313.43 was unexpended. DOE has reviewed each of the reported expenditures and concluded that all reported expenditures comply with the spending limitations stated in section 5(d)(2)(E)(i) of the Act.

32365 (DOE/FTR–93014639) **Trip to United Kingdom and France to determine what foreign technology is to be incorporated into the Multipurpose Processing and Storage Complex design: Foreign trip report, April 19–30, 1993.** Wolfe, B.A.; Nyman, D.H.; Dev, M. Westinghouse Hanford Co., Richland, WA (United States). 1 Jun 1993. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93014639. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This trip by members of the Multipurpose Processing and Storage Complex (MPSC) Project was to determine what foreign technology is to be incorporated into the MPSC design and to share information with the British and French, regarding the purpose and scope of the MPSC. The United States (US) delegation consisted of representatives from the US Department of Energy (DOE) Richland Operations Office (RL), and Westinghouse Hanford Company (WHC). This report represents a summary of information presented and discussed, as well as facilities viewed chronologically by the US delegation. Additional detail is available from tour participants, upon request.

32366 (DOE/FTR–93014804) **Travel to France to report on Waste Management projects at WIPP and Yucca Mountain: Foreign trip report, February 2–8, 1992.** Anderson, D.R. Sandia National Labs., Albuquerque, NM (United States). 6 Apr 1992. 284p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93014804. Source: OSTI; NTIS (US Sales Only); GPO Dep.

In attendance at the Performance Assessment, Advisory Group (PAAG) meeting in Paris were the OECD/NEA Radiation Protection and Waste Management Division staff, and the NEA Data Bank staff. Twelve nations were represented, as well as the Commission of the European Communities (CEC) and the International Atomic Energy Agency (IAEA). An attendance list is attached (Annex 1). Because this was the first PAAG meeting in 18 months, the entire agenda (Annex 2) was taken up by progress reports on various PAAG-sponsored and PAAG-related activities. As per the PAAG charger, recommendations for follow-on work were made as part of the review of on going work. Notable among recommendations were: (1) that the PSACOIN Level 2 Exercise, a code intercomparison study, should go forward as planned, (2) that a one-day topical discussion on Conceptual Model Uncertainty (CMU) is to be part of the next PAAG meeting, and (3) that the results of that topical discussion will be factored into a full Workshop addressing this topic, and may lead to the formation of a CMU Working Group. A number of nations reported progress and changes in their radioactive waste disposal programs. A highlight is the recent licensing of a geologic disposal system for intermediate level waste in Finland, which now beings to accept waste. Texts of presentations are attached as Annexes 26-46.

32367 (DOE/FTR–93014868) **Travel to Australia to attend a workshop on INTRAVAL, an International Project to Study Validation of Geosphere Transport Models: Foreign trip report, February 10–14, 1992.** Gorham, E.D.; Beauheim, R.L.; Corbet, T.F. Sandia National Labs., Livermore, CA (United States). 17 Mar 1992. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93014868. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The WIPP project participates in INTRAVAL, an International Project to Study Validation of Geosphere Transport Models. Two WIPP test cases have been accepted by the INTRAVAL. Collaborative work is conducted on the WIPP Salt Test Case (WIPP-I) in Working Group III and on the WIPP Culebra Test Case (WIPP-II) in Working Group II. The annual INTRAVAL General Workshops are alternately held in the United States and Europe. The European meeting was relocated to Australia to convenience a large Australian INTRAVAL membership.

32368 (DOE/FTR–93015303) **Travel to Paris, France for the third meeting of the NEA Coordinating Group on site evaluation and design of experiments for radioactive waste disposal (SEDE): Foreign trip report, January 28–31, 1992.** Tillerson, J.R. Sandia National Labs., Albuquerque, NM (United States). 26 Feb 1992. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93015303. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A trip was taken to Paris, France to actively participate in the OECD/NEA/SEDE coordinating group meeting. The meeting was held to identify interest in and potential projects for international cooperation that contribute to confidence building in site characterization capabilities. Participation would likely cost the WIPP program about $30K/year; the most likely focus of efforts will be in flow in fractured media although no recognition was given to similar, ongoing cooperative efforts. discussions at the BGR in Hannover and during a visit to the Asse Mine in Germany identified that the construction of an important full-scale seal is about 1/3 complete and that details of planning, analysis, construction, and testing activities are of direct interest to the planning of large-scale seal tests needed within the next two years at the WIPP site. The large-scale test was planned because the staff and advisory committees believe they could not expect success without full-scale demonstrations of the construction and performance evaluations of seals.

32369 (DOE/FTR–93015807) **Travel to Switzerland for performance assessments for both the low- and intermediate-level and high-level radioactive waste disposal programs being managed and implemented by NAGRA: Foreign trip report, May 2–9, 1993.** Van Luik, A.E. INTERA, Inc., Las Vegas, NV (United States). 9 Jun 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC01-91RW00134. Order Number DE93015807. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The traveler was asked to participate in this PAAG Core Group meeting by the Yucca Mountain Site Characterization Project Office (the Project Office). A request had been received by the Project Office to send a representative, and recommending that it be the traveler since he has been a working member of the PAAG since 1985. The Core Group serves at the convenience of the PAAG Chairman. The primary purpose of the Core Group meeting is to set the agenda for the next full PAAG meeting and draw up the recommendations for actions that are to be presented to the full PAAG. An auxiliary purpose of this travel was to obtain information on recent performance assessment development at NAGRA. Discussions were held regarding progress in performance assessments for both the low- and intermediate-level, and high-level radioactive waste disposal programs being managed and implemented by NAGRA. It is expected that the official announcement of a preferred low- and intermediate-level waste disposal site, for further characterization, is to be made in June 1993.

32370 (DOE/FTR–93015993) **Travel to Australia for workshop of the INTRAVAL program in which potential radionuclide migration in the geosphere is predicted: Foreign trip report, February 7–15, 1992.** Voss, C.F. (Golder Associates, Inc., Redmond, WA (United States)). Pacific Northwest Lab., Richland, WA (United States). 28 Feb 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93015993. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of this trip was to participate in the 2nd Phase-2 Workshop of the INTRAVAL Study. The workshop was sponsored by the Australian Nuclear Science & Technology Organization (ANSTO). The workshop was intended to provide a forum for technical exchange concerning the various test cases in INTRAVAL and the planning of additional work that will be performed during the upcoming months. The detailed trip report includes the following information: the relationship of the content of the workshop to Department of Energy activities in the United States; observations

about the scientific programs and government policies concerning the validation of numerical models for simulating the performance of geological repositories for nuclear waste; recommendations concerning future or follow-up activities; a detailed agenda of the workshop; and a bibliography of literature obtained at the workshop.

32371 (DOE/FTR–93017128) **Travel to Europe to visit various underground waste disposal sites: Foreign trip report, May 10–20, 1993.** Arthur, J. (USDOE, Washington, DC (United States)); Ellis, D.; Weart, W. Sandia National Labs., Livermore, CA (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93017128. Source: OSTI; NTIS (US Sales Only); GPO Dep.

England's Department of Environment is in charge of all policies associated with all radioactive waste programs as well as the authorizing license. The United Kingdom's (UK) Department of Energy, which is under the UK's Department of Transportation, has the role of Conducting the safety assessment (the dose to workers) as well as being a stockholder in Nirex, which is in charge of deep geologic repository development. We were briefed on the current planning associated with the Nirex development of the deep geologic repository near the Sellafield/Driggs area of the UK. The facility is currently in the drilling stages collecting various geotechnical data and will plan at the end (f 1993 to permit an underground laboratory. After construction, key geotechnical information will be collected for approximately five years, at which time they will plan to go operational. One of the keys to gaining acceptance in the region was to involve the public in discussions of the facility in an early stage. Because of opposition to negative visual impacts, the original plan to access the underground by shafts (which require tall headframes), the design was changed to provide access by a long, inclined ramp. The Nirex projected waste volume is approximately two million cubic meters of material that is low level and intermediate level, of which about 400,000 cubic meters would be intermediate level waste. The plans are to initiate operations in the year 2010 with approximately a 50-year operation.

32372 (DOE/FTR–93017243) **Travel to Korea for conference on nuclear waste management: Foreign trip report, October 20–25, 1991.** Slate, S.C. (comp.) (Pacific Northwest Lab., Richland, WA (United States)); Choi, A.S.; Cook, J.R.; Colombo, P. USDOE Idaho Operations Office, Idaho Falls, ID (United States). 27 May 1992. 24p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93017243. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This biennial meeting has had major DOE involvement in the past and the expected benefits from this meeting are significant. The conference included presentations and discussions on topics such as advanced waste treatment; decontamination and decommissioning; handling of gaseous, liquid, and solid wastes; high-level waste treatment; licensing issues; regulatory issues; safety issues; waste solidification; storage, transportation, and disposal; and volume reduction. Also included were two technical tours to the Wolson Nuclear Plant and the research facilities at the Korea Atomic Energy Research Institute. Because DOE and its contractors are a major sponsor of waste management activities, DOE participation was extremely beneficial.

32373 (DOE/FTR–93017249) **Travel to the United Kingdom to attend and participate in Nuclear Energy Agency Probabilistic System Assessment Group's Level 2 Exercise Task Group meeting: Foreign trip report, May 3–10, 1992.** Marietta, M.G.; Gallegos, D.P. Sandia National Labs., Albuquerque, NM (United States). 22 May 1992. 58p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93017249. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report discusses travel to the United Kingdom for a meeting of the Level 2 Exercise Task Group of the Probabilistic System Assessment Group (PSAG) of the Office of Economic Cooperation and Development's (OECD) Nuclear Energy Agency (NEA) was held in Melton Mowbray, UK, on May 5–8, 1992. The case specification for the Probabilistic System Assessment Code Intercomparison (PSACOIN) Level 2 Exercise drafted by Sandia National Laboratories was discussed, modified, and approved by the task group. The exercise will proceed in stages. The specification approved by the task group is for the first stage which is expected to take one year for completion. Stage two will require a new problem specification. The overall objectives, as presently stated pending approval by PSAG at the upcoming June meeting, of the exercise are: 1. to assemble model treatments of a single system using a variety of conceptual models, and thus to explore the effect of conceptual model uncertainty; 2. to study progressively the effect of incorporating conceptual model uncertainty into different components of the system; 3. to study for different performance measures the relative impact of conceptual model uncertainty; and 4. to study methods for derivation of pdfs for model parameters, and to explore how this process interacts with the range of conceptual models considered. These objectives cannot be met without additional input from a proposed NEA Conceptual Model Uncertainty Working Group to be discussed at the September Performance Assessment Advisory Group (PAAG) meeting.

32374 (DOE/ID–10347) **Idaho National Engineering Laboratory Waste Management Operations Roadmap Document.** Bullock, M. EG and G Idaho, Inc., Idaho Falls, ID (United States). Apr 1992. 390p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93016685. Source: OSTI; NTIS; INIS; GPO Dep.

At the direction of the Department of Energy-Headquarters (DOE-HQ), the DOE Idaho Field Office (DOE-ID) is developing roadmaps for Environmental Restoration and Waste Management (ER&WM) activities at Idaho National Engineering Laboratory (INEL). DOE-ID has convened a select group of contractor personnel from EG&G Idaho, Inc. to assist DOE-ID personnel with the roadmapping project. This document is a report on the initial stages of the first phase of the INEL's roadmapping efforts.

32375 (DOE/ID/13215–T1) **INEL cold test pit demonstration of improvements in information derived from non-intrusive geophysical methods over buried waste sites: Phase 1, Final report.** Coleman Energy and Environmental Systems, Golden, CO (United States). Blackhawk Geosciences Div. 8 Sep 1993. 94p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-93ID13215. Order Number DE93040363. Source: OSTI; NTIS; INIS; GPO Dep.

The objectives of this research project were to lay the foundation for further improvement in the use of geophysical methods for detection of buried wastes, and to increase the information content derived from surveys. Also, an important goal was to move from mere detection to characterization of buried wastes. The technical approach to achieve these objectives consisted of: (1) Collect a data set of high spatial density; (2) Acquire data with multiple sensors and integrate the interpretations inferred from the various sensors; (3) Test a simplified time domain electromagnetic system; and (4) Develop imaging and display formats of geophysical data readily understood by environmental scientists and engineers. The breadth of application of this work is far reaching. Not only are uncontrolled waste pits and trenches, abandoned underground storage tanks, and pipelines found throughout most US DOE facilities, but also at military installations and industrial facilities. Moreover, controlled land disposal sites may contain "hot spots" where drums and hazardous material may have been buried. The technologies addressed by the R&D will benefit all of these activities.

32376 (DOE/LLW–144) **Guidelines for mixed waste minimization.** Owens, C. EG and G Idaho, Inc., Idaho Falls, ID (United States). Feb 1992. 94p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93017394. Source: OSTI; NTIS; INIS; GPO Dep.

Currently, there is no commercial mixed waste disposal available in the United States. Storage and treatment for commercial mixed waste is limited. Host States and compacts region officials are encouraging their mixed waste generators to minimize their mixed wastes because of management limitations. This document provides a guide to mixed waste minimization.

32377 (DOE/LLW–170) **Economics of a small-volume low-level radioactive waste disposal facility.** EG and G Idaho, Inc., Idaho Falls, ID (United States); Dames and Moore, Denver, CO

(United States). Apr 1993. 125p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93017395. Source: OSTI; NTIS; INIS; GPO Dep.

This report was prepared by the US Department of Energy National Low-Level Waste Management Program to present the results of a life-cycle cost analysis of a low-level radioactive waste disposal facility, including all support facilities, beginning in the pre-operational phase and continuing through post-closure care. The disposal technology selected for this report is earth-covered concrete vaults, which use reinforced concrete vaults constructed above grade and an earth cover constructed at the end of the operational period for permanent closure. The report develops a design, cost estimate, and schedule for the base case and eight alternative scenarios involving changes in total disposal capacity, operating life, annual disposal rate, source of financing and long-term interest rates. The purpose of this analysis of alternatives is to determine the sensitivity of cost to changes in key analytical or technical parameters, thereby evaluating the influence of a broad range of conditions. The total estimated cost of each alternative is estimated and a unit disposal charge is developed.

32378 (DOE/MWIP–9) **Mixed Waste Integrated Program: A technology assessment for mercury-containing mixed wastes.** Perona, J.J.; Brown, C.H. Oak Ridge National Lab., TN (United States). Mar 1993. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/M–2965). Order Number DE93019953. Source: OSTI; NTIS; INIS; GPO Dep.

The treatment of mixed wastes must meet US Environmental Protection Agency (EPA) standards for chemically hazardous species and also must provide adequate control of the radioactive species. The US Department of Energy (DOE) Office of Technology Development established the Mixed Waste Integrated Program (MWIP) to develop mixed-waste treatment technology in support of the Mixed Low-Level Waste Program. Many DOE mixed-waste streams contain mercury. This report is an assessment of current state-of-the-art technologies for mercury separations from solids, liquids, and gases. A total of 19 technologies were assessed. This project is funded through the Chemical-Physical Technology Support Group of the MWIP.

32379 (DOE/MWIP–10) **Evaluation of nitrate destruction methods.** Taylor, P.A. (Oak Ridge National Lab., TN (United States)); Kurath, D.E.; Guenther, R. Oak Ridge National Lab., TN (United States). 30 Mar 1993. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/M–2966). Order Number DE93019952. Source: OSTI; NTIS; INIS; GPO Dep.

A wide variety of high nitrate-concentration aqueous mixed [radioactive and Resource Conservation and Recovery Act (RCRA) hazardous] wastes are stored at various US Department of Energy (DOE) facilities. These wastes will ultimately be solidified for final disposal, although the waste acceptance criteria for the final waste form is still being determined. Because the nitrates in the wastes will normally increase the volume or reduce the integrity of all of the waste forms under consideration for final disposal, nitrate destruction before solidification of the waste will generally be beneficial. This report describes and evaluates various technologies that could be used to destroy the nitrates in the stored wastes. This work was funded by the Department of Energy's Office of Technology Development, through the Chemical/Physical Technology Support Group of the Mixed Waste Integrated Program. All the nitrate destruction technologies will require further development work before a facility could be designed and built to treat the majority of the stored wastes. Several of the technologies have particularly attractive features: the nitrate to ammonia and ceramic (NAC) process produces an insoluble waste form with a significant volume reduction, electrochemical reduction destroys nitrates without any chemical addition, and the hydrothermal process can simultaneously treat nitrates and organics in both acidic and alkaline wastes. These three technologies have been tested using lab-scale equipment and surrogate solutions. At their current state of development, it is not possible to predict which process will be the most beneficial for a particular waste stream.

32380 (DOE/NV/10872–11) **DOE Waste Package Project: Quarterly progress report, April 1, 1993–June 30, 1993 and end of year summary report.** Ladkany, S.G. Nevada Univ., Las Vegas, NV (United States). [1993]. 74p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC08-90NV10872. Order Number DE93018957. Source: OSTI; NTIS; GPO Dep.

Contents of this report are as follows: Overview and progress of waste package project and container design; waste container alternate design considerations; structural analysis and design of nuclear waste package canister; manipulation of the nuclear waste container; design requirements of various rock tunnel shapes for long term storage of high level waste; and transport phenomena in the near field.

32381 (DOE/OR–01-1135-D2) **Federal Facility Agreement plans and schedules for liquid low-level radioactive waste tank systems at Oak Ridge National Laboratory, Oak Ridge, Tennessee.** Oak Ridge National Lab., TN (United States). Jun 1993. 117p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ;AC05-76OR00001. (ES/ER–17-D1/R1). Order Number DE93016908. Source: OSTI; NTIS; INIS; GPO Dep.

The Superfund Amendments and Reauthorization Act of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requires a Federal Facility Agreement (FFA) for federal facilities placed on the National Priorities List. The Oak Ridge Reservation was placed on that list on December 21, 1989, and the agreement was signed in November 1991 by the Department of Energy Oak Ridge Field Office (DOE-OR), the US Environmental Protection Agency (EPA)-Region IV, and the Tennessee Department of Environment and Conservation (TDEC). The effective date of the FFA was January 1, 1992. Section 9 and Appendix F of the agreement impose design and operating requirements on the Oak Ridge National Laboratory (ORNL) liquid low-level radioactive waste (LLLW) tank systems and identify several plans, schedules, and assessments that must be submitted to EPA/TDEC for review or approval. The initial issue of this document in March 1992 transmitted to EPA/TDEC those plans and schedules that were required within 60 to 90 days of the FFA effective date. The current revision of this document updates the plans, schedules, and strategy for achieving compliance with the FFA, and it summarizes the progress that has been made over the past year. Chapter 1 describes the history and operation of the ORNL LLLW System, the objectives of the FFA, the organization that has been established to bring the system into compliance, and the plans for achieving compliance. Chapters 2 through 7 of this report contain the updated plans and schedules for meeting FFA requirements. This document will continue to be periodically reassessed and refined to reflect newly developed information and progress.

32382 (DOE/OR–03-1150-D1) **Design demonstrations for the remaining 19 Category B tank systems at Oak Ridge National Laboratory, Oak Ridge, Tennessee.** Ebasco Services, Inc., Oak Ridge, TN (United States). Jun 1993. 293p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400 ;AC05-91OR21928. (ORNL/M–2810). Order Number DE93016909. Source: OSTI; NTIS; INIS; GPO Dep.

This document presents design demonstrations conducted of liquid low-level waste (LLLW) storage tank systems located at the Oak Ridge National Laboratory (ORNL). ORNL has conducted research in energy related fields since 1943. The facilities used to conduct the research include nuclear reactors, chemical pilot plants, research laboratories, radioisotope production laboratories, and support facilities. These facilities have produced a variety of radioactive and/or hazardous wastes that have been transported and stored through an extensive network of piping and tankage. Demonstration of the design of these tank systems has been stipulated by the Federal Facility Agreement (FFA) between the EPA (United States Environmental Protection Agency)-Region IV; the Tennessee Department of Environment and Conservation (TDEC); and the DOE. The FFA establishes four categories of tank systems: Category A-New or Replacement Tank Systems with Secondary Containment; Category B-Existing Tank Systems with Secondary Containment; Category C-Existing Tank Systems Without Secondary Containment, and Category D-Existing Tank Systems Without Secondary Containment That are Removed from Service. This document provides a design demonstration of the secondary

containment and ancillary equipment of 19 tank systems listed in the FFA as Category B. The design demonstration for each tank is presented in Section 2. The assessments assume that each tank system was constructed in accordance with the design drawings and construction specifications for that system unless specified otherwise. Each design demonstration addresses system conformance to the requirements of the FFA (Appendix F, Section C).

32383 (DOE/RL–90-49) **The 4843 Alkali Metal Storage Facility Closure Plan.** USDOE Richland Operations Office, WA (United States). Jun 1991. 159p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93018406. Source: OSTI; NTIS; INIS; GPO Dep.

Engineering drawings for this project are identified as CAPE-3066. Inquiries may be directed to: Office of Scientific and Technical Information, P. O. Box 62, Oak Ridge, TN 37831.

The 4843 AMSF has been used primarily to provide a centralized building to receive and store dangerous and mixed alkali metal waste, including sodium and lithium, which has been generated at the Fast Flux Test Facility and at various other Hanford Site operations that used alkali metals. Most of the dangerous and mixed alkali metal waste received consists of retired equipment from liquid sodium processes. The unit continues to store material. In general, only solid alkali metal waste that is water reactive is stored at the 4843 AMSF. The 4843 AMSF will be closed in a manner consistent with Ecology guidelines and regulations (WAC 173-303-610). The general closure procedure is detailed as follows.

32384 (DOE/RL–92-24-Vol.1-Rev.1) **Hanford Site background: Part 1, Soil background for nonradioactive analytes: Revision 1, Volume 1.** USDOE Richland Operations Office, WA (United States). Apr 1993. 237p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93017682. Source: OSTI; NTIS; INIS; GPO Dep.

The determination of soil background is one of the most important activities supporting environmental restoration and waste management on the Hanford Site. Background compositions serve as the basis for identifying soil contamination, and also as a baseline in risk assessment processes used to determine soil cleanup and treatment levels. These uses of soil background require an understanding of the extent to which analytes of concern occur naturally in the soils. This report documents the results of sampling and analysis activities designed to characterize the composition of soil background at the Hanford Site, and to evaluate the feasibility for use as Sitewide background. The compositions of naturally occurring soils in the vadose Zone have been-determined for-nonradioactive inorganic and organic analytes and related physical properties. These results confirm that a Sitewide approach to the characterization of soil background is technically sound and is a viable alternative to the determination and use of numerous local or area backgrounds that yield inconsistent definitions of contamination. Sitewide soil background consists of several types of data and is appropriate for use in identifying contamination in all soils in the vadose zone on the Hanford Site. The natural concentrations of nearly every inorganic analyte extend to levels that exceed calculated health-based cleanup limits. The levels of most inorganic analytes, however, are well below these health-based limits. The highest measured background concentrations occur in three volumetrically minor soil types, the most important of which are topsoils adjacent to the Columbia River that are rich in organic carbon. No organic analyte levels above detection were found in any of the soil samples.

32385 (DOE/RL–92-72-Rev.1) **200 Area Effluent Treatment Facility: Delisting petition: Revision 1.** USDOE Richland Operations Office, WA (United States). Aug 1993. 725p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93040412. Source: OSTI; NTIS; INIS; GPO Dep.

Waste water has been generated for over 40 years as a result of operations conducted on the Hanford Site. This waste water previously was discharged to cribs, ponds, or ditches. An example of such waste water includes process condensate that might have been in contact with dangerous waste or mixed waste (containing both radioactive and dangerous components). This petition presents the treatment technologies that are designed into the 200 Area Effluent Treatment Facility to eliminate the dangerous characteristics of the waste and to delist the effluent in accordance with the requirements found in 40 Code of Federal Regulations 260.20 and 260.22. The purpose of this petition is to demonstrate that the 242-A Evaporator process condensate will be treated adequately so that the effluent from the 200 Area Effluent Treatment Facility will no longer require management as a regulated dangerous waste. This demonstration was performed by use of a surrogate (synthetic) waste, designed by the US Department of Energy, Richland Operations Office to include species that represent all organic and inorganic constituents (but not radionuclide species) expected to be found on the Hanford Site. Thus, the surrogate will encompass not only the expected 242-A Evaporator process condensate characteristics, but those of other potential 200 Area Effluent Treatment Facility waste streams and additional 40 CFR Appendix VIII constituents.

32386 (DOE/RL–93-08) **Hanford Mission Plan: Volume 1, Site Guidance.** Garrison, H.L. USDOE Richland Field Office, WA (United States). Aug 1993. 72p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93019979. Source: OSTI; NTIS; INIS; GPO Dep.

The 1993 Hanford Mission Plan (HMP), Volume I, Site Guidance, provides technical guidance and direction to Hanford Site programs. Program planning for fiscal year (FY) 1994 and beyond shall be based on this guidance. This technical guidance includes statements of Site and program missions and provides a common set of assumptions on which plans and decisions will be based. It also provides descriptions of important interfaces across mission areas and programs, cross-cutting and sitewide issues that must be resolved, and a methodology to resolve them.

32387 (DOE/RL–93-39) **National emission standards for hazardous air pollutants application for approval to construct rotary mode core-sampling truck and exhauster.** USDOE Richland Field Office, WA (United States). May 1993. 16p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93019977. Source: OSTI; NTIS; INIS; GPO Dep.

Characterization of wastes in the underground single-shell tanks and double-shell tanks on the Hanford Site is crucial in developing the final disposal options for the waste and closure strategy for the Hanford Site. Additionally, characterization of tank waste is important for the waste tank safety programs. The Hanford Federal Facility Agreement and Consent Order (also referred to as the Tri-Party Agreement) Milestone M-10-00 requires the obtaining and analyzing of at least two samples from each single-shell tank, and Milestone M-10-13 specifically requires the ability to sample hard saltcake. Existing equipment does not allow sampling of all single-shell tanks within established tank safety limits. Consequently, the US Department of Energy, Richland Operations Office has developed a rotary mode core-sampling system that uses nitrogen gas to cool and clear the drill bit. A rotary mode core-sampling truck will be used on approximately 80 single-shell tanks which contain saltcake wastes, and will provide crucial information on the contents of the tanks. This application is a request for approval to construct and operate the rotary mode core-sampling truck and exhauster in the 200 East and 200 West Area Tank Farms of the Hanford Site. This request is being made pursuant to 40 CFR 61, Subpart H.

32388 (DOE/RL–93-40) **Radioactive air emissions program notice of construction, rotary mode core-sampling truck and exhauster.** USDOE Richland Operations Office, WA (United States). May 1993. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018733. Source: OSTI; NTIS; INIS; GPO Dep.

Efforts have been ongoing to obtain core samples from the contents of each of the Hanford Site's 149 single-shell tanks (SSTs). The SSTs contain various amounts and combinations of liquid, sludge, and saltcake. Existing sampling equipment is unable to retrieve samples of hardened waste within established tank safety restrictions (particularly limits on temperature). A new rotary mode core-sampling system has been designed to sample tanks containing hardened wastes. The prominent feature of this new system is the use of a nitrogen gas purge. The nitrogen gas purge will cool the drill bit and prevent cross contamination of different waste

layers in the tank. The nitrogen gas purge will also allow more complete sample recovery, by clearing cuttings that might otherwise obstruct the sampler or drill bit. Nitrogen was chosen over other compressed gases for its inherent safety. Many of the tanks to be sampled with the rotary mode core-sampling system are not actively ventilated, these tanks are operated at atmospheric pressure with passive (breather) high-efficiency particulate air (HEPA) filters. Unless a ventilation system of the proper capacity is used, addition of the nitrogen purge gas to SSTs will cause the tanks to pressurize. Additionally, the use of the rotary mode core-sampling system will generate aerosols and dusts potentially containing radioactive particles in the tank vapor space. Consequently, an exhauster will be required during operation of the rotary mode core-sampling system on SSTs to prevent tank pressurization and to control emissions. This exhauster will be required to be moved from tank farm to tank farm with the rotary mode core-sampling system.

32389 (DOE/RL–93-41) **Toxic air pollutants notice of construction, rotary mode core-sampling truck and exhauster.** USDOE Richland Operations Office, WA (United States). May 1993. 37p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93018732. Source: OSTI; NTIS; GPO Dep.

Characterization of wastes in the single-shell tanks (SST) and double-shell tanks on the Hanford Site is crucial in developing the final disposal option for the waste and closure strategy for the Site. Additionally, characterization of tank waste is important for the waste tank safety programs. The Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement) (Ecology et al. 1990) Milestone M-10-00 requires obtaining and analyzing at least two samples from each SST, and Milestone M-10-13 specifically requires the ability to sample hard saltcake. Existing equipment, however, does not allow sampling of all SSTs within established tank safety limits. Consequently, the US Department of Energy, Richland Operations Office has developed a rotary mode core-sampling system that uses nitrogen gas to cool and clear the drill bit. A rotary mode core-sampling truck will be used on approximately 80 SSTs that contain saltcake waste, and will provide crucial information on the contents of the tanks. This application is a request for approval to construct and operate the core-sampling truck and exhauster in the 200 East and 200 West Area Tank Farms of the Hanford Site. This request is being made pursuant to Washington Administrative Code (WAC) Chapter 173-460, "Controls for New Sources of Toxic Air Pollutants."

32390 (DOE/RW/00273–T1) **Feasibility study: Assess the feasibility of siting a monitored retrievable storage facility: Phase 1.** King, J.W. Ponca Industrial Corp., Irving, TX (United States). [1993]. 152p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-92RW00273. Order Number DE93019262. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of phase one of this study are: To understand the waste management system and a monitored retrievable storage facility; and to determine whether the applicant has real interest in pursuing the feasibility assessment process. Contents of this report are: Generating electric power; facts about exposure to radiation; handling storage, and transportation techniques; description of a proposed monitored retrievable storage facility; and benefits to be received by host jurisdiction.

32391 (DOE/RW–93016760) **Yucca Mountain Site Characterization Project: Technical data catalog,(quarterly supplement).** USDOE Yucca Mountain Site Characterization Project Office, Las Vegas, NV (United States). 31 Mar 1993. 104p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93016760. Source: OSTI; NTIS; INIS; GPO Dep.

The June 1, 1985, Department of Energy (DOE)/Nuclear Regulatory Commission (NRC) Site-Specific Procedural Agreement for Geologic Repository Site Investigation and Characterization Program requires the DOE to develop and maintain a catalog of data which will be updated and provided to the NRC at least quarterly. This catalog is to include a description of the data; the time (date), place, and method of acquisition; and where it may be examined. The Yucca Mountain Site Characterization Project (YMP) Technical Data Catalog is published and distributed in accordance with the requirements of the Site-Specific Agreement. The YMP Technical Data Catalog is a report based on reference information contained in the YMP Automated Technical Data Tracking System (ATDT). The reference information is provided by Participants for data acquired or developed in support of the YMP. The Technical Data Catalog is updated quarterly and published in the month following the end of each quarter. A complete revision to the Catalog is published at the end of each fiscal year.

32392 (DOE/WIPP–89-003-Rev.1-Vol.1) **Waste Isolation Pilot Plant No-Migration Variance Petition: Revision 1, Volume 1.** Westinghouse Electric Corp., Carlsbad, NM (United States). Waste Isolation Div. Mar 1990. 314p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-86AL31950. Order Number DE93018051. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of the WIPP No-Migration Variance Petition is to demonstrate, according to the requirements of RCRA §3004(d) and 40 CFR §268.6, that to a reasonable degree of certainty, there will be no migration of hazardous constituents from the facility for as long as the wastes remain hazardous. The DOE submitted the petition to the EPA in March 1989. Upon completion of its initial review, the EPA provided to DOE a Notice of Deficiencies (NOD). DOE responded to the EPA's NOD and met with the EPA's reviewers of the petition several times during 1989. In August 1989, EPA requested that DOE submit significant additional information addressing a variety of topics including: waste characterization, ground water hydrology, geology and dissolution features, monitoring programs, the gas generation test program, and other aspects of the project. This additional information was provided to EPA in January 1990 when DOE submitted Revision 1 of the Addendum to the petition. For clarity and ease of review, this document includes all of these submittals, and the information has been updated where appropriate. This document is divided into the following sections: Introduction, 1.0; Facility Description, 2.0; Waste Description, 3.0; Site Characterization, 4.0; Environmental Impact Analysis, 5.0; Prediction and Assessment of Infrequent Events, 6.0; and References, 7.0.

32393 (DOE/WIPP–89-003-Rev.1-Vol.6) **No-migration variance petition: Appendices K–O, Response to notice of deficiencies: Volume 6, Revision 1.** Fischer, N.T. (ed.) (International Technology Corp., Torrance, CA (United States)). Westinghouse Electric Corp., Carlsbad, NM (United States). Waste Isolation Div. Mar 1990. 553p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-86AL31950. Order Number DE93018056. Source: OSTI; NTIS; INIS; GPO Dep.

This document reports data collected as part of the Ecological Monitoring Program (EMP) at the Waste Isolation Pilot Plant near Carlsbad, New Mexico, for Calendar Year 1987. Also included are data from the last quarter (October through December) of 1986. This report divides data collection activities into two parts. Part A covers general environmental monitoring which includes meteorology, aerial photography, air quality monitoring, water quality monitoring, and wildlife population surveillance. Part B focuses on the special studies being performed to evaluate the impacts of salt dispersal from the site on the surrounding ecosystem. The fourth year of salt impact monitoring was completed in 1987. These studies involve the monitoring of soil chemistry, soil microbiota, and vegetation in permanent study plots. None of the findings indicate that the WIPP project is adversely impacting environmental quality at the site. As in 1986, breeding bird censuses completed this year indicate changes in the local bird fauna associated with the WIPP site. The decline in small mammal populations noted in the 1986 census is still evident in the 1987 data; however, populations are showing signs of recovery. There is no indication that this decline is related to WIPP activities. Rather, the evidence indicates that natural population fluctuations may be common in this ecosystem. The salt impact studies continue to reveal some short-range transport of salt dust from the saltpiles. This material accumulates at or near the soil surface during the dry seasons in areas near the saltpiles, but is flushed deeper into the soil during the rainy season. Microbial activity does not appear to be affected by this salt importation. Vegetation coverage and density data from 1987 also do not show any detrimental effect associated with aerial dispersal of salt.

32394 (DOE/WIPP–89-003-Rev.1-Vol.7) **Waste Isolation Pilot Plant No-migration variance petition: Addendum: Volume 7, Revision 1.** Westinghouse Electric Corp., Carlsbad, NM (United

States). Waste Isolation Div. Mar 1990. 402p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-86AL31950. Order Number DE93018057. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes various aspects of the Waste Isolation Pilot Plant (WIPP) including design data, waste characterization, dissolution features, ground water hydrology, natural resources, monitoring, general geology, and the gas generation/test program.

32395 (DOE/WIPP–89-003-Rev.1-Vol.8) **Waste Isolation Pilot Plant: No-migration variance petition: Figures: Volume 8, Revision 1.** Westinghouse Electric Corp., Carlsbad, NM (United States). Waste Isolation Div. Mar 1990. 191p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-86AL31950. Order Number DE93018058. Source: OSTI; NTIS; INIS; GPO Dep.

This report is a compilation of engineering drawings concerned with seal arrangement at the Waste Isolation Pilot Plant (WIPP).

32396 (DOE/WIPP–89-003-Summ.) **Waste Isolation Pilot Plant no-migration variance petition: Executive summary.** International Technology Corp., Torrance, CA (United States). [1990]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-86AL31950. Order Number DE93018040. Source: OSTI; NTIS; INIS; GPO Dep.

Section 3004 of RCRA allows EPA to grant a variance from the land disposal restrictions when a demonstration can be made that, to a reasonable degree of certainty, there will be no migration of hazardous constituents from the disposal unit for as long as the waste remains hazardous. Specific requirements for making this demonstration are found in 40 CFR 268.6, and EPA has published a draft guidance document to assist petitioners in preparing a variance request. Throughout the course of preparing this petition, technical staff from DOE, EPA, and their contractors have met frequently to discuss and attempt to resolve issues specific to radioactive mixed waste and the WIPP facility. The DOE believes it meets or exceeds all requirements set forth for making a successful "no-migration" demonstration. The petition presents information under five general headings: (1) waste information; (2) site characterization; (3) facility information; (4) assessment of environmental impacts, including the results of waste mobility modeling; and (5) analysis of uncertainties. Additional background and supporting documentation is contained in the 15 appendices to the petition, as well as in an extensive addendum published in October 1989.

32397 (DOE/WIPP–91-033C) **WIPP waste acceptance criteria and transportation system.** Wu, C.F.; Ward, T.R.; Gregory, P.C. Westinghouse Electric Corp., Carlsbad, NM (United States). [1991]. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-86AL31950. (CONF-911268–3: CERS '91: Chinese experts radwaste symposium, Taipei (China), 17-18 Dec 1991). Order Number DE93017916. Source: OSTI; NTIS; INIS; GPO Dep.

The Waste Isolation Pilot Plant (WIPP), located near Carlsbad, New Mexico, USA, is a US Department of Energy (DOE) facility designed as a permanent repository for transuranic wastes in the center of a 2,000-foot-thick salt bed situated 2,150 feet underground. Construction of the facility started in 1975, under a congressional act of site selection. In 1979, demonstration of safe disposal at the WIPP was authorized by Public Law 96-164. The operational philosophy and practice at the facility are: (1) start clean – stay clean, (2) meet or exceed regulatory requirements, and (3) control radiation exposure levels to as low as reasonably achievable (ALARA). Strict safety measures must be taken in the areas of waste preparation, transportation, and facility operation.

32398 (DOE/WIPP–91-038C) **Geomechanical monitoring system at the Waste Isolation Pilot Plant, Carlsbad, New Mexico.** Francke, J.L. (Westinghouse Electric Corp., Carlsbad, NM (United States). Waste Isolation Div.); Carrasco, R.C.; Carney, B.C. Westinghouse Electric Corp., Carlsbad, NM (United States). Waste Isolation Div. [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-86AL31950. (CONF-920403–1: 94. annual general meeting of the Canadian Institute of Mining and Metallurgy, Montreal (Canada), 24 Apr 1992). Order Number DE93017918. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes in detail the geomechanical instrumentation system and the database that has been established from the geomechanical monitoring program. In addition, it describes the quality assurance and control measures that are in place to ensure that the data from the underground is accurate, traceable, and defensible. The system is installed at the Waste Isolation Pilot Plant in Carlsbad, New Mexico. This facility is being developed for the disposal of transuranic nuclear wastes in underground excavations in salt 655 meters below the surface. The purpose of the instrumentation system, is to monitor the deformations and stress changes that are occurring in the rock with time. This information is needed to routinely assess conditions in the facility and to ensure that safe operating conditions are maintained. The geomechanical monitoring system has provided data collection, quality control, and database maintenance, all of which are of vital importance to monitoring the geomechanical performance of underground excavations.

32399 (DOE/WIPP–91-040C) **Westinghouse-DOE Integration: Meeting the challenge.** Price, S.V. Westinghouse Electric Corp., Carlsbad, NM (United States). Waste Isolation Div. [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-86AL31950. (CONF-920307–97: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE93017919. Source: OSTI; NTIS; INIS; GPO Dep.

The Westinghouse Electric Corporation (WEC) is in a unique position to affect national environmental management policy approaching the 21st Century. Westinghouse companies are management and operating contractors (MOC,s) at several environmentally pivotal government-owned, contractor operated (GOCO) facilities within the Department of Energy's (DOE's) nuclear defense complex. One way the WEC brings its companies together is by activating teams to solve specific DOE site problems. For example, one challenging issue at DOE facilities involves the environmentally responsible, final disposal of transuranic and high-level nuclear wastes (TRUs and HLWS). To address these disposal issues, the DOE supports two Westinghouse-based task forces: The TRU Waste Acceptance Criteria Certification Committee (WACCC) and the HLW Vitrification Committee. The WACCC is developing methods to characterize an estimated 176,287 cubic meters of retrievably stored TRUs generated at DOE production sites. Once characterized, TRUs could be safely deposited in the WIPP repository. The Westinghouse HLW Vitrification Committee is dedicated to assess appropriate methods to process an estimated 380,702 cubic meters of HLWs currently stored in underground storage tanks (USTs). As planned, this processing will involve segregating, and appropriately treating, low level waste (LLW) and HLW tank constituents for eventual disposal. The first unit designed to process these nuclear wastes is the SRS Defense Waste Processing Facility (DWPF). Initiated in 1973, the DWPF project is scheduled to begin operations in 1991 or 1992. Westinghouse companies are also working together to achieve appropriate environmental site restoration at DOE sites via the GOCO Environmental Restoration Committee.

32400 (DOE/WIPP–91-045C) **The WIPP decision plan: Charting the course for openness in the decision making process.** Hagers, J. Westinghouse Electric Corp., Carlsbad, NM (United States). Waste Isolation Div. [1992]. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-86AL31950. (CONF-920307–Extd.Abst.: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE93017921. Source: OSTI; NTIS; INIS; GPO Dep.

In June of 1989, the Secretary of Energy requested that a plan be developed that would clearly outline the prerequisites to opening the Waste Isolation Pilot Plant (WIPP). It was to provide the basis for a decision making process that was not only visible to the public, but one which included public participation. It must also be dynamic enough to effectively deal with the changing legislative, regulatory, and technical environments. Based on a recognized need for openness, the Secretary's Draft Decision Plan was developed. The plan charted the course for ultimately making the decision to declare WIPP ready to receive waste for the start of test phase operations. It outlined to critics and supporters alike the rigorous and thorough process by which the internal decisions

were made. The plan identified all internal prerequisites to the decision; charted the review cycles, and targeted the completion dates. It also outlined the processes outside the control of the Department, institutional issues, such as legislative land withdrawal, issuance of permits, and designation of transportation routes.

32401 (DOE/WIPP–91-062C) **Public and institutional environmental education in the 1990s.** Price, S.V.; Johnson, P.R. Westinghouse Electric Corp., Carlsbad, NM (United States). [1993]. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-86AL31950. Order Number DE93017923. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. RADIOACTIVE WASTE DISPOSAL/ education; ENVIRONMENT; WIPP; EDUCATION; ALPHA-BEARING WASTES; TRAINING; ENVIRONMENTAL IMPACTS; WASTE MANAGEMENT

32402 (DOE/WIPP–92-006C) **Environmental monitoring and cooperative resource management at the WIPP site.** Westinghouse Electric Corp., Carlsbad, NM (United States). Waste Isolation Div. [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-86AL31950. (CONF-920307–99: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE93017925. Source: OSTI; NTIS; INIS; GPO Dep.

This poster session by the Environmental Monitoring Section of the US DOE Waste Isolation Pilot Plant is to demonstrate that the DOE is committed to sound environmental management. This WIPP poster session demonstrates radiological as well as nonradiological environmental monitoring activities conducted routinely at the WIPP. And how data collected prior to the WIPP being operational is used to establish a preoperational baseline for environmental studies in which the samples collected during the operational phase will be compared. Cooperative Resource Management is a relatively new concept for governments agencies. It allows two or more agencies the ability to jointly share in funding a program or project and yet both agencies can benefit from the outcome. These programs are usually a biological type study. The WIPP cooperative agreement between the US BLM, DOE and its contractors is to continue the ongoing documentation of the diversity of the Chihuahuan desert.

32403 (DOE/WIPP–92-009C) **WIPP alpha CAM fast alarm setpoints.** Steinbruegge, K.B.; Clayton, S.G.; Merkling, T.D. Westinghouse Electric Corp., Carlsbad, NM (United States). Waste Isolation Div. [1992]. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-86AL31950. (CONF-9207122–2: The Fine Particle Society conference, Las Vegas, NV (United States), 14 Jul 1992). Order Number DE93017926. Source: OSTI; NTIS; INIS; GPO Dep.

The Waste Isolation Pilot Plant (WIPP) is a US Department of Energy (DOE) facility planned and built to demonstrate the safe long term storage of plutonium contaminated waste resulting from the nuclear weapons production activities of the United States. While these wastes are all packaged within sealed containers prior to shipment to the WIPP, the danger to human health from plutonium has necessitated extensive safety measures. State-of-the-art monitoring instrumentation has been installed at the WIPP to provide rapid warning of accident situations. The WIPP uses alpha particle CAMs to provide an alarm if significant concentrations of airborne transuranics are present. This paper documents the logic and approach used to determine a fast alarm set-point for the airborne alpha radiation CAMs in service at the WIPP alpha CAMs (Eberline corp. model Alpha-6A) have provisions for two high radiation alarms. These two alarms have been used as a single alarm level by setting them both at the same set points.

32404 (DOE/WIPP–92-014C) **Geomechanical monitoring system at the Waste Isolation Pilot Plant, Carlsbad, New Mexico.** Francke, J.L. (Westinghouse Electric Corp., Carlsbad, NM (United States). Waste Isolation Div.); Cook, R.F.; Carrasco, R.C.; Carney, B.C. Westinghouse Electric Corp., Carlsbad, NM (United States). Waste Isolation Div. [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-86AL31950. (CONF-920634–12: 33. US symposium on rock mechanics, Santa Fe, NM (United States), 3-10 Jun 1992). Order Number DE93017927. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes in detail the geomechanical instrumentation system and the data base that has been established from the geomechanical monitoring program. In addition, it describes the quality assurance and control measures that are in place to ensure that the data from the underground is accurate, traceable, and defensible. The system is installed at the Waste Isolation Pilot Plant in Carlsbad, New Mexico. This facility is being developed for the disposal of transuranic nuclear wastes in underground excavations in salt 2150 feet below the surface. The purpose of the instrumentation system is to monitor the deformations and stress changes that are occurring in the rock with time. This information is needed to routinely assess conditions in the facility and to ensure that safe operating conditions are maintained.

32405 (DOE/WIPP–92-044C) **Safety at the Waste Isolation Pilot Plant.** Wu, Chuan-Fu. Westinghouse Electric Corp., Carlsbad, NM (United States). Waste Isolation Div. [1992]. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-86AL31950. (CONF-9209226–4-Extd.Abst.: American Chemical Society (ACS) special symposium on emerging technologies in hazardous waste management, Atlanta, GA (United States), 21-23 Sep 1992). Order Number DE93017930. Source: OSTI; NTIS; INIS; GPO Dep.

The Waste Isolation Pilot Plant (WIPP) is a Department of Energy (DOE) project designed to demonstrate safe disposal of transuranic (TRU) wastes in the excavations of a salt bed situated 2,150 feet underground. The operational philosophy of the WIPP is threefold: to start clean and stay clean, to meet or exceed regulatory requirements, and to keep radiation exposures as low as reasonably achievable (ALARA). The well-being of the public, the environment, and the workers is the project's first priority. Extensive safety measures have been and will continue to be taken throughout all phases of project activities. This paper describes the major elements of the WIPP safety program which includes a training program with special emphasis on safety, for operations, maintenance, engineering, and all technical support positions; a TRU Package Transporter-II (TRUPACT-II) for safe transportation of TRU waste; radiation protection programs; a volatile organic compound (VOC) monitoring program; and an ALARA committee to oversee and provide guidance to ALARA activities.

32406 (DPE–3481) **Conceptual design report for alpha waste incinerator chemical separations area (79-SR-028).** Spencer, C.D. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). 20 Apr 1977. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–618). Order Number DE93019310. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The objectives of this project are to (a) reduce the volume of all plant-generated alpha-contaminated solid combustible wastes and convert them to a form which can be stored with a low risk of dispersion, (b) provide a facility to incinerate 12 lb/hr of waste by 1981, to conform to the ERDA milestone for halting further storage of combustible wastes, and (c) seal radioactive ash and scrubbing salt residues from incineration into cans for interim storage in drums at burial ground pads. This report includes a summary of the scope of the project, a project cost estimate, a cost and obligations schedule, an objective schedule, standards and criteria for design, a description of excluded costs, an estimate of project energy consumption, packet of key drawings, and an assessment of the environmental impact of the project.

32407 (DPST–75-487) **TRU waste incineration survey: Introduction and summary: Trip report, September 1975.** Hootman, H.E. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Lab. 28 Oct 1975. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–617). Order Number DE93019311. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of the trip detailed in this report was to survey the present experience and technology of incineration of solid TRU waste at other ERDA sites to develop design criteria for a prototype TRU waste incinerator proposed for installation at SRP in the period 1978–1979. The SRP alpha incinerator will process newly

generated TRU waste and provide pilot plant experience for a larger unit scheduled to be started up in 1986 in the Solid Transuranic Waste Processing Facility. Four of the five ERDA sites actively engaged in alpha incineration were visited: Mound Laboratories, Rocky Flats Plant, Battelle Pacific Northwest Laboratories and Atlantic Richfield Hanford Company.

32408 (EGG–10617-2195) **Yucca Mountain biological resources monitoring program: Annual report FY92.** EG and G Energy Measurements, Inc., Goleta, CA (United States). Santa Barbara Operations. Feb 1993. 79p. Sponsored by USDOE, Washington, DC (United States). AC08-88NV10617. Order Number DE93018485. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) is required by the Nuclear Waste Policy Act of 1982 (as amended in 1987) to study and characterize Yucca Mountain as a potential site for a geologic repository for high-level nuclear waste. During site characterization, the DOE will conduct a variety of geotechnical, geochemical, geological, and hydrological studies to determine the suitability of Yucca Mountain as a potential repository. To ensure that site characterization activities (SCA) do not adversely affect the environment at Yucca Mountain, an environmental program has been implemented to monitor and mitigate potential impacts and ensure activities comply with applicable environmental regulations. This report describes the activities and accomplishments of EG&G Energy Measurements, Inc. (EG&G/EM) during fiscal year 1992 (FY92) for six program areas within the Terrestrial Ecosystem component of the YMP environmental program. The six program areas are Site Characterization Effects, Desert Tortoises, Habitat Reclamation, Monitoring and Mitigation, Radiological Monitoring, and Biological Support.

32409 (EGG-GEO–10797) **GWSCREEN: A semi-analytical model for assessment of the groundwater pathway from surface or buried contamination: Version 2.0 theory and user's manual.** Rood, A.S. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jun 1993. 134p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93019026. Source: OSTI; NTIS (documentation only); ESTSC (complete software package), P.O. Box 1020, Oak Ridge, TN 37831-1020; INIS; GPO Dep.

GWSCREEN was developed for assessment of the groundwater pathway from leaching of radioactive and non radioactive substances from surface or buried sources. The code was designed for implementation in the Track I and Track II assessment of CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) sites identified as low probability hazard at the Idaho National Engineering Laboratory (DOE, 1992). The code calculates the limiting soil concentration such that, after leaching and transport to the aquifer, regulatory contaminant levels in groundwater are not exceeded. The code uses a mass conservation approach to model three processes: contaminant release from a source volume, contaminant transport in the unsaturated zone, and contaminant transport in the saturated zone. The source model considers the sorptive properties and solubility of the contaminant. Transport in the unsaturated zone is described by a plug flow model. Transport in the saturated zone is calculated with a semi-analytical solution to the advection dispersion equation in groundwater. In Version 2.0, GWSCREEN has incorporated an additional source model to calculate the impacts to groundwater resulting from the release to percolation ponds. In addition, transport of radioactive progeny has also been incorporated. GWSCREEN has shown comparable results when compared against other codes using similar algorithms and techniques. This code was designed for assessment and screening of the groundwater pathway when field data is limited. It was not intended to be a predictive tool.

32410 (EGG-WMO–10321) **A preliminary evaluation of alternatives for treatment of INEL Low-Level Waste and low-level mixed waste.** Smith, T.H.; Roesener, W.S.; Jorgensen-Waters, M.J.; Edinborough, C.R. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jun 1992. 408p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93019005. Source: OSTI; NTIS; INIS; GPO Dep.

The Mixed and Low-Level Waste Treatment Facility (MLLWTF) project was established in 1991 by the US Department of Energy Idaho Field Office to provide treatment capabilities for Idaho National Engineering Laboratory (INEL) low-level mixed waste and low-level waste. This report identifies and evaluates the alternatives for treating that waste. Twelve treatment alternatives, ranging from "no-action" to constructing and operating the MLLWTF, are identified and evaluated. Evaluations include facility performance, environmental, safety, institutional, schedule, and rough order-of-magnitude cost comparisons. The performance of each alternative is evaluated against lists of "musts" and "wants." Also included is a discussion of other key considerations for decision making. Analysis of results indicated further study is necessary to obtain the best estimate of future waste volumes and characteristics from the expanded INEL Decontamination and Decommissioning Program. It is also recommended that conceptual design begin as scheduled on the MLLWTF, maximum treatment alternative while re-evaluating the waste volume projections.

32411 (ENEA-RT-AMB–92-02) **Cementation of wastes arising from nuclear power plants: Bead ion exchange resins, filter sludges and BWR evaporator concentrates.** De Angelis, G. (ENEA, Casaccia (Italy). Area Energia Ambiente e Salute); Marchetti, A.; Balzamo, S. Mar 1993. 76p. (RT/AMB–92-02). Order Number DE93522947. Source: OSTI; NTIS (US Sales Only).

The general aim of this work is the qualification of samples arising from the cementation of low- and medium-level wastes. In particular, bead ion exchange resins, filter sludges, BWR evaporator concentrates and decontamination solutions were taken into account. The properties of the final waste forms, prepared by means of a MObile WAste conditioning plant (MOWA), were compared with the ones of lab scale samples. Within the framework of a quality assurance programme, the cement mixes were characterized in order to define the process parameters such as set time, heat evolution, presence of free standing liquids, mass and volume efficiency. The qualification of the solidified wastes was performed according to the requirements of the Italian Regulatory Body. Particular attention was devoted to mechanical and thermal properties, biodegradability and behaviour versus water, which proved of relevant importance to demonstrate the retention capacity of the hydraulic cement towards the main contaminants.

32412 (HWVP–89-001-Rev.1) **Hanford Waste Vitrification Plant Project Plan: Revision 1.** Brown, R.W. USDOE Richland Field Office, WA (United States). Jun 1993. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018729. Source: OSTI; NTIS; INIS; GPO Dep.

A major mission of the US DOE is the permanent disposal of Hanford defense wastes by safe, environmentally acceptable, and cost effective methods which meet applicable regulations. The Hanford Waste Vitrification Plant (HWVP) Project was initiated to immobilize the Hanford high-level waste (HLW) and provide interim storage. The HWVP will vitrify the pre-treated HLW into borosilicate glass, cast the glass into stainless steel canisters, and store the canisters on site until they are shipped to a federal geologic repository. The HWVP project objective is to design, construct, and operate a facility for immobilizing defense high-level waste for storage. Technical objectives include using the Defense Waste Processing Facility designed plants systems or elements, where practical, and the exchange and review of information on plants in foreign countries. More definitive objectives for quality, reliability, environmental, and safety are provided in the HWVP Project Management Plan.

32413 (HWVP–89-007-Rev.3) **Quality assurance program description: Hanford Waste Vitrification Plant, Part 1: Revision 3.** USDOE Richland Field Office, WA (United States). [1992]. 132p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-92RL12434. Order Number DE93018409. Source: OSTI; NTIS; INIS; GPO Dep.

This document describes the Department of Energy's Richland Field Office (DOE-RL) quality assurance (QA) program for the processing of high-level waste as well as the Vitrification Project Quality Assurance Program for the design and construction of the Hanford Waste Vitrification Plant (HWVP). It also identifies and describes the planned activities that constitute the required quality assurance program for the HWVP. This program applies to the

broad scope of quality-affecting activities associated with the overall HWVP Facility. Quality-affecting activities include designing, purchasing, fabricating, handling, shipping, storing, cleaning, erecting, installing, inspecting, testing, maintaining, repairing, and modifying. Also included are the development, qualification, and production of waste forms which may be safely used to dispose of high-level radioactive waste resulting from national defense activities. The HWVP QA program is made up of many constituent programs that are being implemented by the participating organizations. This Quality Assurance program description is intended to outline and define the scope and application of the major programs that make up the HWVP QA program. It provides a means by which the overall program can be managed and directed to achieve its objectives. Subsequent parts of this description will identify the program's objectives, its scope, application, and structure.

32414 (INIS-JP–008, pp. 475-483) **Radiological protection aspects of geological disposal of high-level radioactive waste.** Matsuzuru, Hideo (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Kimura, Hideo. Japan Atomic Energy Research Inst., Tokyo (Japan). 1992. 558p. (CONF-9203223–: International conference on radiation effects and protection, Mito (Japan), 18-20 Mar 1992). In *Proceedings of the international conference on radiation effects and protection.* Order Number DE93764166. Source: OSTI; NTIS; INIS.

A high-level radioactive waste, generated at a nuclear fuel reprocessing plant, will be disposed of deep, i.e., several hundred meters, within geological formations, to isolate it from the human environment. Since the waste contains significant amounts of long-lived radionuclides, such as Tc-99, I-129, Cs-135 and transuranic elements, the safety of its disposal, particularly as regards the requirement for the radiological protection of human and his environment even in the far future, is one of the essential subjects of all countries engaged in nuclear power production. The radiological protection system has long been established and applied to regulate radiation exposures to the public associated with a relatively short-term release of radioactive materials, during normal and accidental conditions, from nuclear installations such as a power plant and reprocessing plant. Radioactive waste disposal, which potentially offers a long-term radiological consequence on the public, inevitably produces a specific requirement, from the standpoint of radiological protection, that individuals and populations in the future should be accorded at least a current level of the protection. This requirement has caused a serious debate, among the community of radiological protection, on how to establish radiological protection standards and criteria, and how to establish safety assessment methodologies to demonstrate compliance with them. We have discussed in this paper on specific items such as numerical guides to indicate radiological consequences, time frames over which calculations of the consequences are to be carried out, uncertainties to be involved in the calculations, and safety assessment methodologies. (author).

32415 (LA-SUB–93-185) **Colloid transport code-nuclear user's manual.** Jain, R. (New Mexico Univ., Albuquerque, NM (United States)). Los Alamos National Lab., NM (United States); New Mexico Univ., Albuquerque, NM (United States). 3 Apr 1992. 84p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93018276. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the CTCN computer code, designed to solve the equations of transient colloidal transport of radionuclides in porous and fractured media. This Fortran 77 package solves systems of coupled nonlinear differential equations with a wide range of boundary conditions. The package uses the Method of Lines technique with a special section which forms finite-difference discretizations in up to four spatial dimensions to automatically convert the system into a set of ordinary differential equations. The CTCN code then solves these equations using a robust, efficient ODE solver. Thus CTCN can be used to solve population balance equations along with the usual transport equations to model colloid transport processes or as a general problem solver to treat up to four-dimensional differential systems.

32416 (LA-SUB–93-242) **Report on the effectiveness of flocculation for removal of ^{239}Pu at concentrations of 1 pCi/L and 0.1 pCi/L: RFP Pond Water Characterization and Treatment (LATO-EG&G-91-022): Task C deliverables: 5.1.2 and 5.2.2.** Triay, I.R. (EG and G Rocky Flats, Inc., Golden, CO (United States)); Bayhurst, G.K.; Mitchell, A.J.; Cisneros, M.R.; Efurd, D.W.; Roensch, F.R.; Rokop, D.J.; Aguilar, R.D.; Attrep, M.; Nuttall, H.E. Los Alamos National Lab., NM (United States); EG and G Rocky Flats, Inc., Golden, CO (United States). 1993. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93019304. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this work is to assess the effectiveness of flocculation for the removal of Pu from Rocky Flats Plant (RFP) pond waters spiked with ^{239}Pu at the 1.0 and 0.1 pCi/L level. The flocculation treatment procedure is described in detail. Results are presented for treatment studies for the removal of Pu from C-2 pond water spiked with ^{239}Pu and from distilled water spiked with ^{239}Pu.

32417 (LA-SUB–93-257) **An assessment of radiolytic gas generation: Impacts from Rocky Flats Plant residue elimination alternatives: Final report.** Los Alamos National Lab., NM (United States); Science Applications International Corp., Golden, CO (United States). 26 Feb 1993. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93019299. Source: OSTI; NTIS; INIS; GPO Dep.

This report evaluates the Sandia National Laboratory-Albuquerque analytical model that is used to support present wattage limit decisions for various matrix forms from the Residue Elimination Project for Waste Isolation Pilot Plant waste acceptability. This study includes (1) a comparison of the SNL-A model to Rocky Flats Plant models for consistency of assumptions and the phenomena considered in the models, and (2) an evaluation of the appropriateness of the Sandia National Laboratory-Albuquerque model to Rocky Flats Plant residues, considering that the original intent was to model wastes rather than residues. The study draws the following conclusions: (1) only real-time gas generation testing of specific waste streams may provide a sound basis for an increase in the transportation wattage limit of specific waste streams, and (2) the radiolytic gas generation rate from Residue Elimination Project waste emplaced at Waste Isolation Pilot Plant, under worst-case conditions, is not a significant factor in comparison to the total gas generation rate due to radiolysis, microbial degradation, and corrosion.

32418 (LA-SUB–93-258) **Impact of a delay in the completion of the Defense Waste Processing Facility.** Los Alamos National Lab., NM (United States). 30 Jan 1989. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93019298. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the results of an analysis and evaluation of a delay in completion of the Defense Waste Processing Facility (DWPF) at the DOE Savannah River Plant (SRP). The report describes the precipitate hydrolysis problem, which is causing fouling on the hydrolysis reactor coils, and lists several solutions SRP personnel are researching. Estimates on the cost and timeline implications range from several hundred thousand dollars and a few months to a hundred million dollars and several years.

32419 (LA-UR–93-2171) **Neutronics-processing interface analyses for the Accelerator Transmutation of Waste (ATW) aqueous-based blanket system.** Davidson, J.W.; Battat, M.E. Los Alamos National Lab., NM (United States). [1993]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930913–11: Global '93: future nuclear systems - emerging fuel cycles and waste disposal options, Seattle, WA (United States), 12-17 Sep 1993). Order Number DE93016606. Source: OSTI; NTIS; INIS; GPO Dep.

Neutronics-processing interface parameters have large impacts on the neutron economy and transmutation performance of an aqueous-based Accelerator Transmutation of Waste (ATW) system. A detailed assessment of the interdependence of these blanket neutronic and chemical processing parameters has been performed. Neutronic performance analyses require that neutron transport calculations for the ATW blanket systems be fully coupled with the blanket processing and include all neutron absorptions in candidate waste nuclides as well as in fission and transmutation

products. The effects of processing rates, flux levels, flux spectra, and external-to-blanket inventories on blanket neutronic performance were determined. In addition, the inventories and isotopics in the various subsystems were also calculated for various actinide and long-lived fission product transmutation strategies.

32420 (LA-UR–93-2261) **Response of actinides to flux changes in high-flux systems.** Sailor, W.C. Los Alamos National Lab., NM (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-931160–14: American Nuclear Society (ANS) winter meeting, San Francisco, CA (United States), 14-19 Nov 1993). Order Number DE93018347. Source: OSTI; NTIS; INIS; GPO Dep.

When discussing the transmutation of actinides in accelerator-based transmutation of waste (ATW) systems, there has been some concern about the dynamics of the actinides under high transient fluxes. For the condition of a pure neptunium feed, it has been estimated that the $^{238}Np/^{237}Np$ ratio increase due to an increasing flux may lead to an unstable, positive reactivity growth. In the analysis here a perturbation method is used to calculate the response of the entire set of actinides in a general way, that allows for more species than just Np. The time response of the system can be calculated, i.e., a plot of fuel composition and reactivity versus time after a change in flux can be made. The effects of fission products can also be included. The procedure extremely accurate on short time scales (~1000 sec) for the flux levels we contemplate. Calculational results indicate that the reactivity insertions are always smaller than previously estimated.

32421 (LA-UR–93-2440) **Aqueous nitrate flowsheet optimization and enhancement using the ATLAS facility.** Schreiber, S.B.; Punjak, W.A.; Yarbro, S.L. Los Alamos National Lab., NM (United States). Aug 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9308137–4: 1993 summer national American Institute of Chemical Engineers (AIChE) conference, Seattle, WA (United States), 15-18 Aug 1993). Order Number DE93018356. Source: OSTI; NTIS; INIS; GPO Dep.

The Advanced Testing Line for Actinide Separations (ATLAS) is a pilot plant of all aqueous nitrate plutonium recovery and purification operations within the Los Alamos Plutonium Facility. The main unit operations include dissolution, anion exchange, precipitations, evaporation, calcination, and waste stream polishing. In the current political environment, the emphasis has been redirected from the traditional goal of recovering a pure plutonium product to that of generating "clean" effluents while placing the plutonium into a form suitable for long term storage. The ATLAS facility is uniquely suited to fulfill this new role in the development and demonstration of new or revisited technologies. This report summarizes recent work in equipment improvements to the batch dissolver, an evaluation of homogeneous hydroxide precipitations, a demonstration of nitric acid recycle, and the preparation of neptunium and plutonium standards.

32422 (LA-UR–93-2584) **Data acquisition and control system for the High-Level Waste Tank Farm at Hanford, Washington.** Hoida, H.W. (Los Alamos National Lab., NM (United States)); Hatcher, C.R.; Trujillo, L.T.; Holt, D.H.; Vargo, G.F.; Martin, J.; Stastny, G.; Echave, R.; Eldridge, K. Los Alamos National Lab., NM (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930749–37: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93018548. Source: OSTI; NTIS; INIS; GPO Dep.

The High-Level Nuclear Waste Storage Tank 241-SY-101 periodically releases flammable gasses. Mitigation experiments to release the gasses continuously to avoid a catastrophic build-up are planned for FY93 and beyond. Los Alamos has provided a data acquisition and control system (DACS) to monitor and control mitigation experiments on SY-101. The DACS consists of a data acquisition trailer to house the electronic components and computers in a friendly environment, a computer system running process control software for monitoring and controlling the tests, signal conditioners to convert the instrument signals to a usable form for the DACS, programmable logic controllers to process sensor signals and take action quickly, a fast data acquisition system for recording transient data, and a remote monitoring system to monitor the progress of the experiment. Equipment to monitor the release of the gasses was also provided. The first experiment involves a mixer pump to mix the waste and allow the gasses to be released at the surface of the liquid as the gas is being formed. The initial tests are scheduled for July 1993.

32423 (LA-UR–93-2605) **Design and fabrication of the uranium drum standards.** Hsue, F.; Long, S.M.; Hsue, S.T.; Miller, M.C. Los Alamos National Lab., NM (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930749–42: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93018542. Source: OSTI; NTIS; INIS; GPO Dep.

The segmented gamma scanner has become an important instrument for assaying the special nuclear material content of low-density scrap and waste in 55-gal. drums. To perform these assays accurately, we need appropriate standards to calibrate the response of the system including the detector efficiency, the absorber in front of the detector, and the collimator geometry. A set of three uranium drum standards has been fabricated at Los Alamos. This paper discusses a Monte Carlo calculation to optimize the design of the drums. The drum standards are prepared using 20 modular 4-ℓ bottles in each drum. This paper also describes the fabrication procedure, which includes weighing the uranium oxide and the chemical analyzing of the uranium concentration. Also presented is the vertical scanning data of the 4- ℓ bottles to assure uniform mixing of the uranium and the diluent. Finally, the nondestructive measurements for checking consistency among the three drum standards are discussed.

32424 (LA-UR–93-2608) **Composite waste analysis system.** Wachter, J.R.; Hagan, R.C.; Bonner, C.A.; Malcom, J.E.; Camp, K.L. Los Alamos National Lab., NM (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930749–44: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93018540. Source: OSTI; NTIS; INIS; GPO Dep.

Nondestructive analysis (NDA) of radioactive waste forms an integral component of nuclear materials accountability programs and waste characterization acceptance criterion. However, waste measurements are often complicated by unknown isotopic compositions and the potential for concealment of special nuclear materials in a manner that is transparent to gamma-ray measurement instruments. To overcome these complications, a new NDA measurement system has been developed to assay special nuclear material in both transuranic and low level waste from the same measurement platform. The system incorporates a NaI detector and customized commercial software routines to measure small quantities of radioactive material in low level waste. Transuranic waste analysis is performed with a coaxial HPGE detector and uses upgraded PC-based segmented gamma scanner software to assay containers up to 55 gal. in volume. Gamma-Ray isotopics analysis of both waste forms is also performed with this detector. Finally, a small neutron counter using specialized software is attached to the measurement platform to satisfy safeguards concerns related to nuclear materials that are not sensed by the gamma-ray instruments. This report describes important features and capabilities of the system and presents a series of test measurements that are to be performed to define system parameters.

32425 (LA-UR–93-2624) **Bias investigation of a 55-gallon drum-sized segmented gamma scanner.** Hurd, J.R.; Long, S.M.; Sampson, T.E. Los Alamos National Lab., NM (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930749–34: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93018477. Source: OSTI; NTIS; INIS; GPO Dep.

This paper addresses a series of studies undertaken while fulfilling the measurement requirements for certification of a 55-gallon drum-sized segmented gamma scanner to be used at the plutonium

facility (TA-55) at Los Alamos. These studies were initiated to investigate anomalies seen in the data as well as gain a quantifiable understanding of effects caused by using standards of considerably different geometric proportions than the assay items, oftentimes necessitated due to lack of adequate standards. The first investigation concerned effects caused by items not being exactly centered on the measurement table. The remaining studies involved establishing the magnitude of the bias induced by so-called "end effects" as well as by size differences between calibration standards and assay items. In order to unravel the above effects, can and drum parameter files were interchangeably employed in conjunction with comparisons of the instrument calibrations obtained with can-sized standards and 55-gallon drum standards. The paper will discuss the results and the magnitude of the observed effects.

32426 (LA-UR–93-2706) **Comments on: "The use of conditional simulation in nuclear waste site performance assessment".** Wendelberger, J.; Beckman, R. Los Alamos National Lab., NM (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93018292. Source: OSTI; NTIS; INIS; GPO Dep.

In the assessment of underground storage of nuclear waste, at locations like the Waste Isolation Pilot Plan (WIPP) one of the greatest concerns is encroachment of the repository and transportation of radionuclides from the repository to the surrounding environment by the groundwater. This paper demonstrates the contribution that can be made in the studies of this important problem and similar problems of national importance by the application of modern statistical techniques.

32427 (LA-UR–93-2761) **Equilibrium modeling of the formation of zeolites in fractures at Yucca Mountain, Nevada.** Chipera, S.J.; Bish, D.L.; Carlos, B.A. Los Alamos National Lab., NM (United States). [1993]. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9306100–4: Zeolite 93: 4th international conference on the occurrence, properties, and utilization of natural zeolites, Boise, ID (United States), 20-28 Jun 1993). Order Number DE93018290. Source: OSTI; NTIS; INIS; GPO Dep.

Yucca Mountain, in southern Nevada, is currently being investigated to determine its suitability to host the first US high-level nuclear waste repository. One of the reasons that Yucca Mountain was chosen for study is the presence of thick sequences of zeolite-rich horizons. In as much as fractures may serve as potential pathways for aqueous transport, the minerals that line fractures are of particular interest. Zeolites are common in fractures at Yucca Mountain and consist mainly of clinoptilolite/heulandite and mordenite although sporadic occurrences of chabazite, erionite, phillipsite, and stellrite have been identified using X-ray powder diffraction. To understand better the conditions under which the observed zeolite species were formed, thermodynamic data were estimated and calculations of log $a((K^+)^2/Ca^{++})$ versus log $a((Na^+)^2/Ca^{++})$ were conducted at various temperatures and silica activities. Using present-day Yucca Mountain water chemistries as a lower constraint on silica activity, clinoptilolite/heulandite and mordenite are still the zeolite species that would form under present conditions.

32428 (NEI-SE–118) **Treatment and final disposal of nuclear waste: Detailed R and D-programme 1993-1998.** Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Sep 1992. 187p. Order Number DE94600313. Source: OSTI; NTIS; INIS.

Background report to RD and D programme 92.

The present background report to RD and D-programme 93 'Detailed R and D-programme 1993-1998' gives a detailed description of the state-of-the-art and future plans for safety assessments and supportive research. The technical development that is required for the construction of the encapsulation station and the deep repository for demonstration deposition is described. The report describes the need for performance and safety assessments occasioned by the above plans for activities. Against the background of the time schedule for safety reports etc., an account is given of the state-of-the-art, goals and planned work during the period with regard to the engineered barriers of spent nuclear fuel, canister material and buffer and backfill material. State-of-the-art, goals and planned work within the geosciences for groundwater movements, bedrock stability and geohydrological and rock mechanical calculation models are presented as well as the situation within the chemistry programme, with separate sections on groundwater and geochemistry, radionuclide chemistry and validation of processes in transport model and radionuclide migration. The study of such natural conditions as constitute analogues in certain respects to important chemical sorption and transport processes in a deep repository is presented. The state of knowledge concerning radionuclide transport in the biosphere and modelling of the same, as well as resulting doese to man, are described. R and D efforts associated with the development of technology that is required for repository construction, excavation of tunnels, deposition of waste and possibly necessary retrieval of canisters, as well as backfilling and sealing of the repository are presented.

32429 (NUREG/CP–0040, pp. 1-7) **Hydrologic research for performance assessment.** Sagar, B. (Center for Nuclear Waste Regulatory Analyses, San Antonio, TX (US)). Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

Radioisotopes in either the spent fuel or processed waste (such as glass) stored in an underground geologic repository would eventually find their way into the ground water. When such releases would occur, rates of these releases in either the aqueous or the gas phase, rates of transport to the biosphere of the isotopes as dissolved species or colloidal particles in the liquid phase and as volatized particles in the gas phase are germane to assessing the safety of the disposal system. The sciences dealing with flow and transport of fluids in geologic materials are central to the successful development and licensing of the geologic repository. Geologic repositories are supposed to provide permanent disposal of the nuclear waste. No long-term (>100 years) active human management and control of the repository is expected after permanent closure. The problem is that the future performance of the repository has to be established with some reasonable confidence, preferably at the time that construction begins, but certainly before decision for permanent closure is made. In the case of the geologic repository this problem is particularly difficult because the time frames are tens of thousands of years; the geologic materials vary in space and are difficult to characterize; space scales are tens of kilometers; predictive models for estimating future performance are very difficult to verify and validate; and there is little recourse for corrective action after closure. This paper describes what is expected to be calculated during assessment of the performance as defined in the regulations. 5 refs.

32430 (NUREG/CP–0040, pp. 14-22) **On the relationship between information content and model structure: Advective travel (time) versus dispersion.** Neuman, S.P. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

This paper reviews some key EPA standards and NRC regulations concerning the role of the geologic settling in barring radionuclide migration from high-level nuclear waste repositories to the accessible environment. Questions based on these standards and regulations are presented, and a theoretical framework within which at least some of the questions could be answered is discussed. 8 refs.

32431 (NUREG/CP–0040, pp. 23-26) **Tracer transport in fractures.** Tsang, Y.W. (Lawrence Berkeley Lab., CA (US)). Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

A fractured medium represents a strongly heterogeneous system. If the matrix permeability is negligibly small compared to the fracture permeability, the flow and transport approximately take place in 2D fractures in a highly heterogeneous 3D space. However, the whole fracture plane is not uniformly conductive to water, rather, flow channeling occurs, that is, the majority of flow concentrates in flow paths of least resistance as demonstrated in recent experimental studies. These features specific to fluid flow in a fractured medium imply that tracer transport is such a medium cannot usually be interpreted by theories which assume flow in a homogeneous porous medium. In the following I describe a new approach to study tracer transport in fractured media. The approach is based on the concept of the variable aperture channel model, in which transport through fractured rocks is controlled by a number of channels, each of which has variable aperture along its length. These variable apertures sample the aperture probability distribution function which characterize a single fracture. The flow channels are not physical pipes in the fracture plane, but rather preferred paths of least resistance in the sense of potential theory. Flow and transport through a system of fractures is then envisioned as occurring through these tortuous channels of flow paths from fracture to fracture in the 3D space. Advective dispersion arises then from the possibility of different channels available for transport, and hence the dispersion displayed in tracer breakthrough measurements can be correlated to the geometric parameters of the fractures. This approach is applied to the analysis of Stripa 3D field data. 16 refs.

32432 (NUREG/CP–0040, pp. 27-36) **Nonequilibrium fracture-matrix flow during episodic infiltration events in Yucca Mountain.** Buscheck, T.A. (Lawrence Livermore National Lab., NM (US)); Nitao, J.J. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. Contract W-7405-Eng-48. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

This report examines the impact of nonequilibrium fracture-matrix flow on episodic infiltration events in Yucca Mountain. For both the FMMM and ECM calculations, a ponded boundary condition is maintained at the repository horizon until the liquid front has broken through to the water table. The relative impact of matrix imbibition is examined for the five major hydrostratigraphic units between the repository horizon and the water table. The question of what sequencing of infiltration events gives rise to episodic behavior versus behavior which may be time-aggregated is also addressed. The implications of nonequilibrium fracture-matrix flow on radionuclide transport are briefly discussed. 19 refs., 7 figs., 5 tabs.

32433 (NUREG/CP–0040, pp. 37-42) **Update on intravalphase II test cases.** Nicholson, T.J. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

The issues of flow and transport through unsaturated rock related to high-level radioactive waste (HLW) disposal are also being addressed in the INTRAVAL Project. The INTRAVAL Project is an international cooperative project for studying validation issues associated with geosphere transport models. The central theme for the INTRAVAL Project is the critical examination of validation issues for evaluating geosphere transport models that may be used in the performance assessment of HLW facilities. This presentation summarizes the project structure, test cases, test case selection criteria, and validation issues. 9 refs., 2 tabs.

32434 (NUREG/CP–0040, pp. 54-63) **Nonisothermal hydrologic transport study at the Apache Leap Tuff site.** Rasmussen, T.C. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

A field-scale heater test is proposed for investigating coupled hydrologic, thermal, and mechanical processes in unsaturated fractured rock related to the disposal of high-level radioactive waste in an underground repository. Observations of fluid flow and solute transport in nonisothermal, unsaturated, fractured rock under controlled, experimental conditions are limited, and the proposed experiment will provide data sets for use in verifying conceptual and computer models related to HLW isolation in an environment where substantial quantities of heat energy are produced by HLW. Previous nonisothermal experiments with tuff have demonstrated the need for additional field scale experiments conducted under controlled initial and boundary conditions using more sophisticated and reliable monitoring systems. 8 figs., 1 tab.

32435 (NUREG/CP–0040, pp. 64-68) **Apache leap watershed study.** Anderson, I. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

The fate of rainfall once it reaches the ground surface is an important characterization parameter since precipitation is an important source term for flow of water through the subsurface. This study provides data sets which will allow estimates of the potential for infiltration, deep percolation, and recharge as the result of rainfall. 3 figs., 1 tab.

32436 (NUREG/CP–0040, pp. 69-71) **Pneumatic permeability measurements in a fractured, partially saturated environment.** Guzman, A.; Sully, M.; Neuman, S.; Lohrstorfer, C. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

In the context of underground disposal of high-level radioactive wastes, the hydraulic conductivity of the host environment is an extremely important parameter. The research task of the authors

addresses the technical design of instrumentation and the theoretical aspects of air flow through fractured, unsaturated rocks. Determinations of the pneumatic permeability are being conducted at different scales in selected boreholes located in unsaturated tuff at the Apache Leap Tuff site. 1 fig.

32437 (NUREG/CP–0040, pp. 72-78) **Geochemical and isotopic studies in the Apache leap region.** Lyons, E.A.; Bassett, R.L. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

Classical and isotopic geochemistry, as well as mass balance reaction modeling are useful tools for understanding the flow and chemical processes in unsaturated fractured rock. In this paper geochemical and isotopic research in progress at the Apache Leap study area is summarized with the presentation of preliminary results. 5 refs., 5 figs.

32438 (NUREG/CP–0040, pp. 79-83) **Field testing the effectiveness of pumping to remove sulfur hexafluoride traced drilling air from a prototype borehole near superior, Arizona.** Peters, C.A. (Denver Federal Center, Lakewood, CO (US)); Striffler, P.; Yang, I.C.; Ferarese, J. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

The US Geological Survey (USGS), Department of the Interior is conducting studies at Yucca Mountain, Nevada, to provide hydrologic, hydrochemical, and geologic information to evaluate the suitability of Yucca Mountain for development as a high-level nuclear-waste repository. The USGS unsaturated-zone hydrochemistry study involves the collection of gas and water samples from the unsaturated zone for chemical and isotopic analyses. Results from these analyses will aid in the understanding of the movement of gas and water in the rock units at Yucca Mountain. A prototype borehole designated USW UZP5 was drilled by the US Department of Energy, Yucca Mountain Site Characterization Project Office (DOE, YMSCPO) in June 1990 in the Apache Leap Tuff of south-central Arizona. The hole was dry drilled with air using sulfur hexafluoride (SF_6) as a tracer. This drilling method simulated that which will be used to drill boreholes for the collection of gas and water samples at Yucca Mountain. The purpose of tracing the drilling air is to quantify its removal by pumping, prior to sampling of in situ gases. The objectives of our work in Arizona were to: (1) Determine the amount of time and the pumping rates required to remove the SF_6-enriched drilling air without inducing additional atmospheric contamination; (2) collect core samples for uniaxial compression to determine the amount of SF_6 gas that penetrated the core during drilling; (3) test the effectiveness of the SF_6 injection and sampling system; (4) test the installation and effectiveness of the prototype packer system; and (5) test the effectiveness of several core sealing methods. 1 fig., 1 tab.

32439 (NUREG/CP–0040, pp. 84-87) **The behavior of simple fluids in microfractures.** Cushman, J.H. (Purdue Univ., West Lafayette, IN (US)); Diestler, D.J.; Schoen, M. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. DOE Contract FG02-85ER60310. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

The behavior of fluids in molecularly narrow microfractures (vicinal fluids) differs from that of their bulk-phase counterparts. The differences are especially dramatic when the fractures are lass than 10 fluid molecular diameters in width. The behavior of fluids in these ultrathink fractures is poorly understood. This talk discusses recent efforts to begin to understand these fluids on the molecular and continuum scales. 9 refs., 2 figs.

32440 (NUREG/CP–0040, pp. 88-100) **Characterization of rock hydrologic properties using model verification.** Flint, A.L. (Geological Survey, Mercury, NV (US)); Richards, K.A.; Flint, L.E. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

Model simulation of imbibition is proposed as a technique to test the adequacy of moisture characteristic and relative permeability data and the ability of the Brooks and Corey and van Genuchten equations to represent that data. The moisture characteristic data was collected using pressure plate, gas drive and submersible pressure outflow cell techniques. The relative permeability data was collected using centrifuge and gas drive techniques. The various relative permeability and moisture characteristic equations were used in a numerical flow simulator to model a laboratory imbibition experiment under two different initial conditions (5% and 46.6% saturation). For the one core tested, the sorption data from the submersible pressure outflow cell composited with the dry end of the centrifuge moisture characteristic curve and the gas drive relative permeability data using the Brooks and Corey equation proved the best fit for modeling imbibition. 10 refs., 6 figs., 2 tabs.

32441 (NUREG/CP–0040, pp. 101-115) **Numerical and laboratory investigations of transient and steady-state flow in a fractured core.** Kwicklis, E.M. (Geological Survey, Lakewood, CO (US)); Thamir, F.; Healy, R.W.; Boughton, C.J.; Anderton, S. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

An improved understanding of the ability of fractures to transmit water at matric potentials less than zero is essential for evaluating the ability of the rocks of Yucca Mountain, Nevada, to safely isolate nuclear waste. Numerical and experimental investigations of this subnuclear waste. Numerical and experimental investigations of this subject will help substantiate flux estimates of both liquid water and water vapor at Yucca Mountain, aid in assessing the effectiveness of capillary barriers at the contact between nonwelded and fractured welded units, and may provide insight as to the manner in which flow may become concentrated along specific pathways through a network of fractures under conditions of partial saturation. This paper summarizes some of the numerical and laboratory investigations that have been conducted at the US Geological Survey in Denver on a core of welded tuff containing a single fracture parallel to the core axis. The objectives of these investigations were to (1) explore the possibility that the unsaturated hydrologic properties of a fracture could be estimated by applying inverse techniques to the results of transient imbibition experiments, and (2) evaluate the accuracy of estimates of unsaturated fracture hydrologic properties derived from transient tests or numerical

modeling through direct steady-state measurements. The core examined in these experiments is 0.0699 m long and has a radius of 0.0208 m. It was obtained from the "columnar zone" of the Tiva Canyon member of the Paintbrush Tuff near Wren Wash on Yucca Mountain. 10 refs., 12 figs.

32442 (NUREG/CP–0040, pp. 116-125) **Ground water flow through unsaturated fractured rock research needs.** Ford, W. (Nuclear Regulatory Commission, Washington, DC (US)). Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

This report presents: (1) a discussion of unsaturated fractured rock flow concepts; (2) a summary of unsaturated fractured rock flow modeling methods; and (3) a discussion of scientific investigations that may be needed to build confidence in the numerical modeling of ground water flow through unsaturated fractured rock. At the present time few experiments have been identified that test the concepts of unsaturated flow in fractured rock. Further, neither the continuum, discrete fracture network, nor the stochastic analytic modeling approaches to modeling ground water flow through unsaturated rock have been tested against either laboratory or field experiments. 17 refs.

32443 (NUREG/CP–0040, pp. 126-129) **Modeling heterogeneous unsaturated flow systems.** Ababou, R. (Center for Nuclear Waste Regulatory Analyses, San Antonio, TX (US)). Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

To adequately model large-scale flow and radionuclide transport in naturally heterogeneous unsaturated rock formations, the inherently three-dimensional spatial variability, stratification, and fracturation of porous geologic media must be accounted for. In particular, it is now increasingly recognized that accurate modeling of radionuclide transport over large space-time scales depends on an adequate representation, in the simulated flow system, of a hierarchy of natural heterogeneities and/or fractures of many sizes and shapes. Moreover, in the case of unsaturated flow, the spatial features of geologic media must be represented through nonlinear matrix/fracture hydrodynamic properties. In what follows, some possible approaches towards realistic large-scale unsaturated flow modeling will be discussed, and some initial results and analyses will be presented. We focus here on the solution of the flow problem as a prerequisite to reliable solute transport simulation. To summarize, one of the main difficulties in large-scale subsurface modeling of flow and transport is the existence of a complex three-dimensional hierarchy of natural geologic heterogeneities. Moreover, in the case of partially saturated or unsaturated flow, this difficulty is compounded by the nonlinear nature of the governing equations owing to the nonlinear pressure-dependence of water retention and hydraulic conductivity.

32444 (NUREG/CP–0040, pp. 130-141) **Use of a submersible pressure outflow cell for determination of moisture characteristic curves on rock core.** Flint, L.E. (Fenix and Scisson, Inc., Mercury, NV (US)); Flint, A.L. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

A simple device for developing moisture characteristic data curves, the submersible pressure outflow cell, was modified for application to rock core at matric potentials of 0 to -0.5 megapascals (MPa) and possibly to -1.0 Mpa. An automated system was developed to continuously and simultaneously collect data from many cells, obtain sorption and desorption characteristic curves to provide hysteretic information, and data from multi-step outflow experiments. The latter can be used to estimate unsaturated hydraulic conductivity. The system has resolved many of the problems inherent in standard measurement techniques. Model simulation of imbibition using the hysteretic data collected are in close agreement with laboratory measurements of imbibition, data collected are in close agreement with laboratory measurements of imbibition, suggesting the moisture characteristic data correctly describes the core properties.19 refs., 4 figs.

32445 (NUREG/CP–0040, pp. 142-146) **Coupled processes.** Tsang, C.F. (Lawrence Berkeley Lab., CA (US)). Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. DOE Contract AC03-76SF00098. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

A nuclear waste repository emplaced in a geologic formation is a major perturbation to the system, inducing various hydrological, chemical, mechanical and thermal processes. Hydrological processes (H) include fluid flow and tracer transport through a rock joint and transient pore fluid pressure changes of system conditions(such as those occurring during the operation of an injection or pumping well, or the construction of underground space). Chemical processes (C) include dissolution or precipitation of solutes in the fluid, interaction of the solutes with each other forming complexes or colloids, and interaction of the solutes with joint surfaces and joint infill materials. Mechanical processes (M) include dilation, shear, joint propagation, and fracturing at joint tips. Finally thermal processes (T) include changes of temperature and presence of transient temperature gradients. These four different kinds of processes may be one-way coupled, i.e., the progress of one process affecting the progress of another, or fully coupled, i.e., the progress of one process affecting the progress of another and vice versa simultaneously. The coupled processes that result from such coupling may have significant impact on the performance of a nuclear waste geologic repository, and on a more basic, local scale, are important for the understanding of the behavior of rock fractures. 18 refs.

32446 (NUREG/CP–0040, pp. 147-152) **Modeling hydrothermal flow in variably saturated, fractured, welded tuff during the prototype engineered barrier system field test of the Yucca Mountain Project.** Buscheck, T.A. (Lawrence Livermore National Lab., CA (US)); Nitao, J.J. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. Contract W-7405-Eng-48. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

The Yucca Mountain Project (YMP) of the US Department of Energy (DOE) is investigating the suitability of the tuffaceous rocks occurring in the unsaturated zone at Yucca Mountain, Nevada for nuclear waste storage. The Engineered Barrier System Field Tests

(EBSFT) will be conducted within the Topopah Spring member of the Paintbrush Tuff at Yucca Mountain, primarily to examine the thermohydrological response of the repository environment of thermal loading from waste packages (Yow, 1985). The Prototype Engineered Barrier System Field Test (PEBSFT) was carried out by Ramirez and others (1989, 1990) in G-Tunnel complex of the Nevada Test Site to test and evaluate components of the geophysical instrumentation network and to support the validation of thermohydrological models. This report describes the modeling of the PEBSFT carried out by Buscheck and Nitao (1990) with the V-TOUGH code (Nitao, 1989) which is a modified version of the TOUGH code (Pruess, 1987). 7 refs., 5 figs., 2 tabs.

32447 (NUREG/CP–0040, pp. 153-160) **A survey of hydrothermal modeling related to Yucca Mountain.** Wescott, R.G. (Nuclear Regulatory Commission, Washington, DC (US)). Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

Present design requirements call for the emplacement of approximately 62,000 metric tons of commercial reactor spent fuel and 8,000 metric tons of Defense and West Valley vitrified high level waste in a geologic repository (USDOE, 1988). The proposed underground repository at Yucca Mountain will cover an area of over two square miles and will have a design areal thermal power density of 57 kilo-watts per acre. Most of the initial decay heat is due to fission products, however long lived actinides and daughter elements will provide significant thermal output after the fission products have decayed to a steady but much lower thermal output level (USNRC, 1983). Depending on the container loadings and emplacement configuration, temperatures in excess of 100 deg. C can occur in the emplacement media and significantly higher temperatures can occur in the waste package. In that the host rock is partially saturated, water can significantly affect heat transfer near the waste package and possibly beyond the repository as well. The purpose of this paper is to present a survey of various efforts involving hydrothermal modeling for the high-level waste repository at Yucca Mountain. These efforts are discussed according to the size or distance scale of modeling supported. The conclusion section presents the author's views as to how these various efforts may be used. Data and information needs are also outlined. 35 refs.

32448 (NUREG/CP–0040, pp. 161-168) **Nonisothermal laboratory and numerical experiment results.** Green, R.T. (Center for Nuclear Waste Regulatory Analyses, San Antonio, TX (US)); Svedeman, S.J.; Martin, R.H.; Dodge, F.T. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

Thermohydrological processes as related to a high-level waste repository are investigated by performing non-isothermal experiments and analyses of partially-saturated media. The objective is to better understand the processes that contribute to the complex flow phenomena expected to be present near high-level waste emplaced in a geologic medium. The preliminary results of two recent laboratory experiments have been analyzed. The laboratory experiments are vertically-oriented, two-dimensional chambers with a vertically-oriented simulated fracture. The experiment is non-isothermal with the vertical end plates maintained at different temperatures. Numerical simulations have been performed using a modified version of the TOUGH code. The intention of performing the simulation is to assist in investigating the thermohydrologic processes and to evaluate the theory incorporated into the TOUGH code. 8 refs., 2 figs.

32449 (NUREG/CP–0040, pp. 169-178) **Flow through non-homogeneous porous media.** Eaton, R.R. (Sandia National Laboratories, Albuquerque, NM (US)); Dykhuizen, R.C.; Hansen, K.M. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. DOE Contract AC04-76DP00789. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

Modeling studies were conducted to determine the effect of material heterogeneities on the flow of water through rock. Multiple numerical calculations were made using random variations in spatial distributions of material properties. The results of these material variations on flow resistance, mechanical dispersion, and channeling were determined. Computed results were compared with a linear analytical model. Good agreement was obtained in the majority of the flow cases investigated. 12 refs., 7 figs.

32450 (NUREG/CP–0040, pp. 179-183) **Evaluation of tracers for hydrologic studies at Yucca Mountain.** Bowman, R.S. (New Mexico Insti. of Mining and Technology, Socorro (US)); Gross, G.W.; Liddle, R.L. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

In order to individually label different water inputs during site characterization and construction of a repository at Yucca Mountain, as many as 30 unique chemical tracers may be required. Only a handful of tracers has been proven suitable for investigations under a broad range of hydrologic and geochemical conditions. An effective tracer is nonreactive, i.e., it is not significantly sorbed nor transformed chemically during the time frame of interest, and it is present naturally at low levels or not at all. Other considerations in choosing a tracer include ease of quantitation, detection limit, environmental hazards, and cost. Tracers to be used under unsaturated conditions must be nonvolatile. Due to the need for more proven tracers for testing at Yucca Mountain (and for hydrological investigations in general), a series of laboratory experiments was performed to evaluate some new and/or little-utilized water tracers. The tracers tested included bromide, iodide, borate, and four fluorinated derivatives of benzoic acid. The emphasis was on testing tracers which could be used under unsaturated as well as saturated conditions. A complete report on the experiments described below (Bowman et al., 1990) is available from the senior author or from the US Geological Survey. 5 refs., 2 figs., 1 tab.

32451 (NUREG/CP–0040, pp. 184-188) **The composition and CO_2 carbon isotope signature of gases from borehole USW UZ-6, Yucca Mountain, Nevada.** Thorstenson, D.C. (Geological Survey National Center, Reston, VA (US)). Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

The monitoring of gas composition and/or flow at a number of unsaturated-zone boreholes at Yucca Mountain has been carried out since 1983 by the USGS. This paper reports the first depth profile of 13C and 14C (from CO2) form the deepest of these boreholes, USW UZ-6. Much of the significance of the data from UZ-6 lies in its relation to data already obtained from other UZ boreholes. 7 refs., 3 figs., 1 tab.

32452 (NUREG/CP–0040, pp. 190-193) **Isotopic tracers for water and solute movement in desert soils.** Phillips, F.M. (New Mexico Inst. of Mining and Technology, Socorro (US)). Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

Most soil-physics investigations focus on agricultural soils and as a result the physics of soil-water processes in desert soils are comparatively poorly understood. Long-term tracer experiments provide valuable information. Among the most useful environmental tracers, from atmospheric nuclear weapons testing, are tritium and chlorine-36. Conclusions of studies of these tracers include the following: thermal vapor diffusions is important in water movement in desert soils; upward refluxing of the liquid phase during the summer separates volatile from non-volatile components; net infiltration rates over 30 years are a few millimeters or less in all soils investigated. 4 refs. 2 figs.

32453 (NUREG/CP–0040, pp. 194-200) **Appraising the use of environmental tracers to determine groundwater recharge rates: The impact of media anisotropy.** McCord, J.T. (Sandia National Laboratories, Albuquerque, NM (US)); Conrad, S.H.; Keller, C.K. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. DOE Contract AC04-76DP00789. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

In the past couple of decades various environmental tracers have been utilized by hydrologists to estimate long-term recharge rates to groundwater aquifers. In general, environmental tracers are readily identifiable constituents of atmospheric precipitation which move through geological media along with the percolating water. These constituents can either be part of the water molecules themselves (such as isotopes of hydrogen and oxygen) or they may be highly soluble, non-reactive solutes (such as chloride). Such constituents are referred to as environmental tracers because they are naturally occurring and because some near-surface process (either natural or anthropogenic) induces some quantifiable characteristic signature in the water. This characteristic signature effectively labels the water, and the label either remains unchanged or else it changes in a predictable fashion as that parcel of water passes through the subsurface environment. Assuming: (1) that the tracer is uniformly applied in space at the field scale, and (2) that one-dimensional vertical downward flow predominates, a variety of models have been developed to estimate average groundwater recharge rates through the unsaturated zone based on environmental tracer concentration versus depth profiles. 15 refs., 4 figs.

32454 (NUREG/CP–0040, pp. 201-210) **Unsaturated flow and transport research questions and priorities.** Chery, D.L. (Nuclear Regulatory commission, Washington, DC (US)). Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

A little over two years ago, a similar meeting (Workshop IV - Flow and Transport through Unsaturated Fractured Rock; Related to High-Level Radioactive Waste Disposal) was held her in Tucson, Arizona, to discuss the same issues discussed here the past 4 days. This presentation revisits what was said 2 years ago, reviews research needs that have been articulated by the licensing staff of the Division of High-Level Waste Management, Nuclear Regulatory Commission, and presents some of the thoughts on research needs resulting from the deliberations of a special committee of the National Research Council. After considering these aspects the questions of what has been accomplished in the past 2 years and where attention and energies should be focused in the coming few years, can be asked. 3 refs.

32455 (NUREG/CP–0040, pp. 211-216) **Technical questions related to modeling groundwater flow and radionuclide transport in unsaturated fractured rock.** Baca, R.; Green, R.; Flint, A.; McCray, J.; Pohl, P.; Rasmussen, T.; Tidwell, V. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

Questions and answers presented in this paper cover the following topics: Liquid/vapor flow in unsaturated fractures; scaling of processes, properties and parameters; coupled processes; prioritize importance of pathways of ground water travel time or release rates; liquid and vapor flow through fault zones; model validation; techniques for designing and evaluating sample representativeness as well as measurement precision and accuracy; instrumentation for moisture content and suction pressure measurement at the laboratory and field scale; long-term climatic effects; depth and rates of infiltration in fractures and faults at both surface and repository elevation.

32456 (NUREG/CP–0040, pp. 217-224) **Technical questions related to modeling ground water flow and radionuclide transport in unsaturated, fractured rock.** Voss, C.; Gallegos, D.; Ababou, R.; Chery, D.; Ford, W.; Gomberg, S.; Hoxie, D.; Lehman, L.; Pruess, K.; Wurstner, S. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

Modeling Research Group 3 has identified a number of general areas for which technical questions remain unanswered. The group further ranked the areas in order of preceived importance. In each area a number of specific questions were raised and in some cases, a strategy was proposed to address those questions. The following issues and concerns are discussed: flow behavior in fractures and fracture/matrix interactions; model validation; need for new and improved modeling; treatment of uncertainty; scale effects; preferential pathways for flow and transport; scenario development and description;definition and treatment of model boundary conditions; treatment of system heterogeneity; experimentation related to modeling; engineering measures to improve performance of the natural barrier.

32457 (NUREG/CP–0040, pp. 225-229) **Technical questions related to modeling groundwater flow and radionuclide transport in unsaturated, fractured rock.** Eaton, R.; Wang, J.; Kaplan, P.; Magnuson, S.; McGraw, M.; Sagar, B.; Tsang, Y.; Updegraff, D.; Wescott, R.; Wittmeyer, G.; Zimmerman, R. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

Group 4 has identified, discussed, and ranked the priority for further study of technical issues in the modeling research area. After listing 42 issues from the members, the group collectively discussed, combined, and casted the issues into 17 questions which were then ranked by voting. The top 10 issues identified by the group are reported in this summary. Justification and possible approaches to study each issue were briefly addressed by the members before these technical questions were presented to the whole workshop. For each issue, the mean value and the standard deviation (as a measure of consensus) for the ranking votes are enclosed in parentheses following the title.Issues include: fracture-matrix interaction;boundary and initial conditions; unsaturated and fracture parameters; formation heterogeneity; numerical experiments; model complexity vs data availability; computational efficiency; couple processes; continuum mechanics and Darcy's law; coupled testing.

32458 (NUREG/CP–0040, pp. 230-232) **Technical issues related to groundwater flow and radionuclide transport in unsaturated fractured rock.** Stuckless, J.S.; Murphy, W.M.; Arredondo, A.; Freeze, A.; Meijer, A.; Phillips, F.; Richards, K.; Stiffler, P. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

Six high priority issues selected from over twenty technical subjects compiled by the group are summarized in this report. They include: regional distribution of chemical and isotopic tracers in deep vadose environments; detailed isotopic data base for comparison with model results; development of isotopic techniques for constraining ground water flow in unsaturated media; investigation of the significance of fracture coating for radionuclide transport in unsaturated media; radionuclide speciation and solubilities in aqueous solutions; appropriate mathematical formulation for radionuclide retardation. No judgement of relative priority is intended by the order of presentation. Technical issues focus primarily on the Yucca Mountain, Nevada proposed repository environment.

32459 (NUREG/CR–5817-Vol.3-No.2) **NRC high-level radioactive waste research at CNWRA, July–December 1992: Volume 3, No. 2.** Sagar, B. (ed.) (Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses); Ababou, R.; Ahola, M. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses. Jul 1993. 222p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). (CNWRA–92-02S-Vol.3-No.2). Source: OSTI; NTIS; INIS; GPO.

Progress from July 1 to December 31, 1992 on the nine NRC-sponsored research projects conducted at the Center for Nuclear Waste Regulatory Analyses is described. Ion-exchange experiments between clinoptilolite and aqueous solutions of Na^+ and Sr^{2+} and three applications of reaction-path modeling are described in the Unsaturated Mass Transport (Geochemistry) project. Numerical simulation of a laboratory-scale non-isothermal two-phase flow is discussed in the Thermohydrology chapter. Methods for estimating rock joint roughness coefficient are the focus of the Seismic Rock Mechanics project for which the Tilt Test, Tse and Cruden's equations, and fractal-based equations were tested and found to be unsatisfactory. In the Integrated Waste Package Experiments chapter, investigations of pit initiation and repassivation potential for alloys 825 and C-22 and stainless steel 304L and 316L are described. Testing of the BIGFLOW computer code and visualization of fracture topology is the theme of the Stochastic Hydrology project. Preliminary analysis of field data from the Akrotiri site in Greece is developed in the Geochemical Analogs project. Mechanistic modeling of sorption using the MINTEQA2 code is investigated as part of the Sorption project. Adaptive gridding and "modified equations" methods for solving the flow and transport equations are described in the Performance Assessment chapter. Finally, the Volcanism chapter focuses on using nonhomogeneous Poisson processes for estimating probability of volcanic events at the potential repository site.

32460 (NUREG/CR–6021) **A literature review of coupled thermal-hydrologic-mechanical-chemical processes pertinent to the proposed high-level nuclear waste repository at Yucca Mountain.** Manteufel, R.D. (Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses); Ahola, M.P.; Turner, D.R.; Chowdhury, A.H. Nuclear Regulatory Commission, Washington, DC (United States). Div. of High-Level Waste Management; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses. Jul 1993. 226p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). (CNWRA–92-011). Source: OSTI; NTIS; INIS; GPO.

A literature review has been conducted to determine the state of knowledge available in the modeling of coupled thermal (T), hydrologic (H), mechanical (M), and chemical (C) processes relevant to the design and/or performance of the proposed high-level waste (HLW) repository at Yucca Mountain, Nevada. The review focuses on identifying coupling mechanisms between individual processes and assessing their importance (i.e., if the coupling is either important, potentially important, or negligible). The significance of considering THMC-coupled processes lies in whether or not the processes impact the design and/or performance objectives of the repository. A review, such as reported here, is useful in identifying which coupled effects will be important, hence which coupled effects will need to be investigated by the US Nuclear Regulatory Commission in order to assess the assumptions, data, analyses, and conclusions in the design and performance assessment of a geologic reposit". Although this work stems from regulatory interest in the design of the geologic repository, it should be emphasized that the repository design implicitly considers all of the repository performance objectives, including those associated with the time after permanent closure. The scope of this review is considered beyond previous assessments in that it attempts with the current state-of-knowledge) to determine which couplings are important, and identify which computer codes are currently available to model coupled processes.

32461 (NWPO-TR–016-91) **Neotectonics of the southern Amargosa Desert, Nye County, Nevada and Inyo County, California.** Donovan, D.E. (Nevada Univ., Reno, NV (United States)). Nevada Nuclear Waste Project Office, Carson City, NV (United States); Nevada Univ., Reno, NV (United States). May 1991. 208p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG08-85NV10461. Order Number DE93018771. Source: OSTI; NTIS; INIS; GPO Dep.

A complex pattern of active faults occurs in the southern Amargosa Desert, southern Nye, County, Nevada. These faults can be grouped into three main fault systems: (1) a NE-striking zone of faults that forms the southwest extension of the left-lateral Rock Valley fault zone, in the much larger Spotted Range-Mine Mountain structural zone, (2) a N-striking fault zone coinciding with a NNW-trending alignment of springs that is either a northward continuation of a fault along the west side of the Resting Spring Range or a

N-striking branch fault of the Pahrump fault system, and (3) a NW-striking fault zone which is parallel to the Pahrump fault system, but is offset approximately 5 km with a left step in southern Ash Meadows. These three fault zones suggest extension is occurring in an E-W direction, which is compatible with the ~N10W structural grain prevalent in the Death Valley extensional region to the west.

32462 (NYSERDA–93018728) **New York State Low-Level Radioactive Waste Status Report for 1992.** Attridge, T.; Rapaport, S.; Yang, Qian. New York State Energy Research and Development Authority, Albany, NY (United States). Jun 1993. 38p. Sponsored by New York State Energy Research and Development Authority, Albany, NY (United States). Source: OSTI; New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, NY 12223.

This report summarizes data on low-level radioactive waste (LLRW) generation in New York State for calendar year 1992. It is based on reports from generators that must be filed annually with the New York State Energy Research and Development Authority (Energy Authority) and on data from the US Department of Energy. The New York State Low-Level Radioactive Waste Management Act (State Act) requires LLRW generators in the State to submit annual reports detailing the classes and quantities of waste generated. This is the seventh year generators have been required to submit reports on their waste to the Energy Authority. The data are summarized in a series of tables and figures. There are three sections in the report. Section 1 covers volume, radioactivity and other characteristics of waste generated in 1992. Section 2 shows historical LLRW generation over the years and includes generators' projections for the next five years. Section 3 provides a list of all facilities for which 1992 LLRW reports were received.

32463 (PNL–8391) **Testing and monitoring plan for the permanent isolation surface barrier prototype.** Gee, G.W.; Cadwell, L.L.; Freeman, H.D.; Ligotke, M.W.; Link, S.O.; Romine, R.A.; Walters, W.H. Jr. Pacific Northwest Lab., Richland, WA (United States). Jun 1993. 71p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93016710. Source: OSTI; NTIS; GPO Dep.

This document is a testing and monitoring plan for a prototype barrier to be constructed at the Hanford Site in 1993. The prototype barrier is an aboveground structure engineered to demonstrate the basic features of an earthen cover system, designed to permanently isolate waste from the biosphere. These features include multiple layers of soil and rock materials and a low-permeability asphalt sublayer. The surface of the barrier consists of silt loam soil, vegetated with plants. The barrier sides are reinforced with rock or coarse earthen-fill to protect against wind and water erosion. The sublayers inhibit plant and animal intrusion and percolation of water. A series of tests will be conducted on the prototype over the next several years to evaluate barrier performance under extreme climatic conditions.

32464 (PNL–8525) **Evaluation of the graphite electrode DC arc furnace for the treatment of INEL buried wastes.** Surma, J.E. (Pacific Northwest Lab., Richland, WA (United States)); Freeman, C.J.; Powell, T.D.; Cohn, D.R.; Smatlak, D.L.; Thomas, P.; Woskov, P.P.; Hamilton, R.A.; Titus, C.H.; Wittle, J.K. Pacific Northwest Lab., Richland, WA (United States). Jun 1993. 67p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93017942. Source: OSTI; NTIS; INIS; GPO Dep.

The past practices of DOE and its predecessor agencies in burying radioactive and hazardous wastes have left DOE with the responsibility of remediating large volumes of buried wastes and contaminated soils. The Buried Waste Integrated Demonstration (BWID), has chosen to evaluate treatment of buried wastes at the Idaho National Engineering Laboratory (INEL). Because of the characteristics of the buried wastes, the potential for using high-temperature thermal treatment technologies is being evaluated. The soil-waste mixture at INEL, when melted or vitrified, produces a glass/ceramic referred to as iron-enriched basalt (IEB). One potential problem with producing the IEB material is the high melting temperature of the waste and soil (1,400-1,600°C). One technology that has demonstrated capabilities to process high melting point materials is the plasma arc heated furnace. A three-party program was initiated and the program involved testing an engineering-scale DC arc furnace to gain preliminary operational and waste processibility information. It also included the design, fabrication, and evaluation of a second-generation, pilot-scale graphite electrode DC arc furnace. Widely ranging simulants of INEL buried waste were prepared and processed in the Mark I furnace. The tests included melting of soils with metals, sludges, combustibles, and simulated drums. Very promising results in terms of waste product quality, volume reduction, heating efficiency, and operational reliability and versatility were obtained. The results indicate that the graphite electrode DC arc technology would be very well suited for treating high melting point wastes such as those found at INEL. The graphite electrode DC arc furnace has been demonstrated to be very simple, yet effective, with excellent prospects for remote or semi-remote operation.

32465 (PNL–8745) **Statistical evaluation of core samples from Hanford tank B110.** Heasler, P.G.; Anderson, C.M.; Baird, D.B.; Serne, R.J.; Whitney, P.D. Pacific Northwest Lab., Richland, WA (United States). Aug 1993. 80p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019981. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents an analysis of the core samples extracted from tank B110. The sampling campaign was quite extensive and resulted in a total of 9,179 chemical analyses on B110 waste. Approximately 70 different chemical constituents were measured in the laboratory, as well m physical and rheological properties. Many different types of replicate measurements were taken so that laboratory, sampling and spatial variability could be quantified. The sampling of tank B110 was part of an in-depth pilot study to determine the adequacy of current chemical analysis and sampling procedures. The major objectives of the analysis included: estimation of the average concentration of the measured analytes in the tank, estimation of the laboratory, sampling, and spatial variability within the tank, and evaluation of the sampling methodology.

32466 (PNL-SA–21514) **Pilot-scale verification test for Hanford grout.** Bagaasen, L.M.; Powell, W.J. Pacific Northwest Lab., Richland, WA (United States). Feb 1993. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930205–80: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 mar 1993). Order Number DE93018788. Source: OSTI; NTIS; INIS; GPO Dep.

The Grout Treatment Facility (GTF) at Hanford, Washington will process the low-level fraction of selected double-shell tank (DST) wastes on the Hanford Site, to produce a cementitious waste form. This facility, which is operated by Westinghouse Hanford Company (Westinghouse Hanford), mixes liquid wastes with cementitious materials and pumps the resulting grout slurry into large [5,300 cubic meters (m^3)] concrete vaults. Once in the vault, the grout cures to produce a waste form that immobilizes radioactive and hazardous constituents through chemical reactions and/or microencapsulation. Although this disposal scheme has several advantages, pouring grout into large vaults raises concerns about how to handle the heat generated from the exothermic hydration reactions that occur as the grout cures. WHC's current strategy for addressing the problem of hydration heat is to fill the vault in stages and use forced ventilation in the airspace above the grout to speed heat removal. The varying composition of Hanford tank waste requires that each tank be processed in a separate campaign using a grout formulation specifically designed for that waste. The next tank scheduled for treatment is DST 241-AN-106. A four-phase process for developing the grout formulation development process is used to assure that the formulation will meet various processing and waste form requirements. These phases are: (1) laboratory formulation development studies and modeling with simulated wastes, (2) laboratory variability studies with simulated waste, (3) pilot-scale verification tests with simulated wastes, and (4) laboratory verification tests with actual waste. This paper presents an overview of the pilot-scale verification tests conducted as part of the grout formulation development for the 241-AN-106 tank waste. The paper specifically discusses results dealing with (1) the grout slurry critical flow rate and (2) the ability to handle grout hydration heat with forced ventilation.

32467 (POEF–3039) **Pallet fire test for steel drum storage on wooden pallets.** Snook, B.L. Portsmouth Gaseous Diffusion Plant, OH (United States). 19 Jun 1992. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-76OR00001. Order Number DE93019688. Source: OSTI; NTIS; GPO Dep.

A fire test was conducted by the Martin Marietta PORTS Fire Protection Engineering Department on October 3, 1991. This test was designed and set up to simulate a proposed storage configuration. The array consisted of 55-gallon steel drums, filled with noncombustible waste material, placed on wooden pallets stacked three tiers high. Results from the test served as the basis for determining the fire protection requirements for this type of storage. Data acquired from the test indicated that relatively high temperatures were obtained from the ignition source. These readings, taken during short durations throughout the test, were recorded from digital readouts connected to individual thermocouples. The test demonstrated that the wooden pallets did not significantly ignite and basically self-extinguished once the ignition source was consumed. Based upon these findings, storage of this type may be placed in the high bay (70 foot ceilings) sprinklered areas. This is providing that good housekeeping is implemented, large ignition sources are not allowed to be stored or parked in the area, and flammable and combustible liquids and solids are not permitted within the storage zones. The area shall also be designated as a "NO SMOKING" area.

32468 (RFP–4730) **The effects of size reduction techniques on TCLP analysis of solidified mixed waste.** Thiel, R.D.; McLaurin, A.W.; Kochen, R.L. EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant. Jul 1993. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC34-90DP62349. (CONF-9307101–3: 9. annual waste testing and quality assurance symposium, Arlington, VA (United States), 12-16 Jul 1993). Order Number DE93018803. Source: OSTI; NTIS; INIS; GPO Dep.

Includes vugraphs.

The Rocky Flats Plant (RFP) generates and stores mixed wastes that are subject to regulation under the Resource Conservation and Recovery Act (RCRA) Land Disposal Restrictions (LDR). Low level mixed wastes at RFP are destined for disposal at the Nevada Test Site (NTS), and thus must meet stringent NTS Waste Acceptance Criteria (WAC), including free liquids, dispersible solids, and Toxicity Characteristic Leaching Procedure (TCLP) requirements. TCLP requires size reduction of the waste form to less than 0.95 centimeters. This can be accomplished by cutting, crushing, or grinding. These classic size reduction methods have the effect of exposing more surface area of the waste. Stabilization technologies under investigation at RFP include polymer encapsulation by co-extruding the waste with low density polyethylene and microwave melting. The objective of this study is to evaluate the effects of different size reduction methods on TCLP results for polyethylene-encapsulated and microwave melted surrogate waste.

32469 (SAND–86-7168) **Geochemical study of evaporite and clay mineral-oxyhydroxide samples from the Waste Isolation Pilot Plant site.** Brookins, D.G. (Univ. of New Mexico, Albuquerque, NM (US). Dept. of Geology). Sandia National Labs., Albuquerque, NM (United States); New Mexico Univ., Albuquerque, NM (United States). Dept. of Geology. Jun 1993. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018677. Source: OSTI; NTIS; INIS; GPO Dep.

Samples of clay minerals, insoluble oxyhydroxides, and their host evaporites from the WIPP site have been studied for their major and minor elements abundances, x-ray diffraction characteristics, K-Ar ages, and Rb-Sr ages. This study was undertaken to determine their overall geochemical characteristics and to investigate possible interactions between evaporates and insoluble constituents. The evaporite host material is water-soluble, having Cl/Br ratios typical of marine evaporites, although the Br content is low. Insoluble material (usually a mixture of clay minerals and oxyhydroxide phases) yields very high Cl/Br ratios, possibly because of Cl from admixed halide minerals. This same material yields K/Rb and Th/U ratios in the normal range for shales; suggesting little, if any, effect of evaporite-induced remobilization of U, K, or Rb in the insoluble material. The rare-earth element (REE) data also show normal REE/chondrite (REE/CHON) distribution patterns, supporting the K/Rb and Th/U data. Clay minerals yield K-Ar dates in the range 365 to 390 Ma and a Rb-Sr isochron age of 428 $\pm$ 7 Ma. These ages are well in excess of the 220- to 230-Ma formational age of the evaporites, and confirm the detrital origin of the clays. The ages also show that any evaporite or clay mineral reactions that might have occurred at or near the time of sedimentation and diagenesis were not sufficient to reset the K-Ar and Rb-Sr systematics of the clay minerals. Further, x-ray data indicate a normal evaporitic assemblage of clay minerals and Fe-rich oxyhydroxide phases. The clay minerals and other insoluble material appear to be resistant to the destructive effects of their entrapment in the evaporites, which suggests that these insoluble materials would be good getters for any radionuclides (hypothetically) released from the storage of radioactive wastes in the area.

32470 (SAND–88-1314) **Waste Isolation Pilot Plant simulated RH TRU waste experiments: Data and interpretation plan.** Molecke, M.A.; Argueello, G.J.; Beraun, R. Sandia National Labs., Albuquerque, NM (United States). Apr 1993. 157p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018516. Source: OSTI; NTIS; INIS; GPO Dep.

The simulated, i.e., nonradioactive remote-handled transuranic waste (RH TRU) experiments being conducted underground in the Waste Isolation Pilot Plant (WIPP) were emplaced in mid-1986 and have been in heated test operation since 9/23/86. These experiments involve the in situ, waste package performance testing of eight full-size, reference RH TRU containers emplaced in horizontal, unlined test holes in the rock salt ribs (walls) of WIPP Room T. All of the test containers have internal electrical heaters; four of the test emplacements were filled with bentonite and silica sand backfill materials. We designed test conditions to be "near-reference" with respect to anticipated thermal outputs of RH TRU canisters and their geometrical spacing or layout in WIPP repository rooms, with RH TRU waste reference conditions current as of the start date of this test program. We also conducted some thermal overtest evaluations. This paper provides a: detailed test overview; comprehensive data update for the first 5 years of test operations; summary of experiment observations; initial data interpretations; and, several status; experimental objectives – how these tests support WIPP TRU waste acceptance, performance assessment studies, underground operations, and the overall WIPP mission; and, in situ performance evaluations of RH TRU waste package materials plus design details and options. We provide instrument data and results for in situ waste container and borehole temperatures, pressures exerted on test containers through the backfill materials, and vertical and horizontal borehole-closure measurements and rates. The effects of heat on borehole closure, fracturing, and near-field materials (metals, backfills, rock salt, and intruding brine) interactions were closely monitored and are summarized, as are assorted test observations. Predictive 3-dimensional thermal and structural modeling studies of borehole and room closures and temperature fields were also performed.

32471 (SAND–88-7054) **Processes, mechanisms, parameters, and modeling approaches for partially saturated flow in soil and rock media: Yucca Mountain Site Characterization Project.** Wang, J.S.Y. (Lawrence Berkeley Lab., CA (United States)); Narasimhan, T.N. Sandia National Labs., Albuquerque, NM (United States); Lawrence Berkeley Lab., CA (United States). Jun 1993. 284p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (LBL–26224). Order Number DE93018768. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses conceptual models and mathematical equations, analyzes distributions and correlations among hydrological parameters of soils and tuff, introduces new path integration approaches, and outlines scaling procedures to model potential-driven fluid flow in heterogeneous media. To properly model the transition from fracture-dominated flow under saturated conditions to matrix-dominated flow under partially saturated conditions, characteristic curves and permeability functions for fractures and matrix need to be improved and validated. Couplings from two-phase

flow, heat transfer, solute transport, and rock deformation to liquid flow are also important. For stochastic modeling of alternating units of welded and nonwelded tuff or formations bounded by fault zones, correlations and constraints on average values of saturated permeability and air entry scaling factor between different units need to be imposed to avoid unlikely combinations of parameters and predictions. Large-scale simulations require efficient and verifiable numerical algorithms. New path integration approaches based on postulates of minimum work and mass conservation to solve flow geometry and potential distribution simultaneously are introduced. This verifiable integral approach, together with fractal scaling procedures to generate statistical realizations with parameter distribution, correlation, and scaling taken into account, can be used to quantify uncertainties and generate the cumulative distribution function for groundwater travel times.

32472 (SAND–90-3074C) **The advantages of a salt/bentonite backfill for Waste Isolation Pilot Plant disposal rooms.** Butcher, B.M. Sandia National Labs., Albuquerque, NM (United States). [1990]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-931108–2: Fall meeting of the Materials Research Society, Boston, MA (United States), 29 Nov - 3 dec 1993). Order Number DE93013763. Source: OSTI; NTIS; INIS; GPO Dep.

This paper concludes that a 70/30 wt % salt/bentonite mixture is preferable to pure crushed salt as backfill for disposal rooms in the Waste Isolation Pilot Plant. The Waste Isolation Pilot Plant, near Carlsbad, NM, is designed to be the first mined geologic repository for the safe disposal of transuranic (TRU) radioactive waste generated by DOE defense programs since 1970. The repository is located about 655 m below the land surface in an extensive bedded salt formation. This report examines the performance of two backfill materials with regard to various selection criteria, such as the need for low permeability after closure, chemical stability, strength, ease of emplacement, and sorption potential for brine and radionuclides. Both salt and salt/bentonite are expected to consolidate to a state of permeability $\leq 10^{-18}$ m^2 that is adequate for satisfying regulations for nuclear repositories. The results of finite-element calculations that were used to arrive at this conclusion will be described. The real advantage of the salt/bentonite. backfill depends, therefore, on bentonite's potential for sorbing brine and radionuclides. Estimates of the impact of these properties on backfill performance are presented.

32473 (SAND–91-0047-Vol.3) **Preliminary performance assessment of the Greater Confinement Disposal facility at the Nevada Test Site: Volume 3: Supporting details.** Price, L.L. (Sandia National Labs., Albuquerque, NM (US)); Olague, N.E.; Conrad, S.H.; Harlan, C.P.; Zimmerman, D.A. Sandia National Labs., Albuquerque, NM (United States). Jun 1993. 200p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018437. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy's Nevada Operations Office (DOE/NV) has disposed of a small quantity of transuranic waste at the Greater Confinement Disposal facility in Area 5 of the Nevada Test Site. In 1989, DOE/NV contracted with Sandia National Laboratories to perform a preliminary performance assessment of this disposal facility. This preliminary performance assessment consisted of analyses designed to assess the likelihood of complying with Environmental Protection Agency standards for the disposal of transuranic waste, high level waste, and spent fuel. The preliminary nature of this study meant that no other regulatory standards were considered and the analyses were conducted with specific limitations. The procedure for the preliminary performance assessment consisted of (1) collecting information about the site, (2) developing models based on this information, (3) implementing these models in computer codes, (4) performing the analyses using the computer codes, and (5) performing sensitivity analyses to determine the more important variables. Based on the results of the analyses, it appears that the Greater Confinement Disposal facility will most likely comply with the Environmental Protection Agency's standards for the disposal of transuranic waste. The results of the sensitivity analyses are being used to guide site characterization activities related to the next iteration of performance assessment analyses for the Greater Confinement Disposal facility.

32474 (SAND–92-0450) **Rock mass mechanical property estimations for the Yucca Mountain Site Characterization Project: Yucca Mountain Site Characterization Project.** Lin, M. (Agapito (J.F.T.) and Associates, Inc., Grand Junction, CO (United States)); Hardy, M.P.; Bauer, S.J. Sandia National Labs., Albuquerque, NM (United States); Agapito (J.F.T.) and Associates, Inc., Grand Junction, CO (United States). Jun 1993. 92p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018522. Source: OSTI; NTIS; INIS; GPO Dep.

Rock mass mechanical properties are important in the design of drifts and ramps. These properties are used in evaluations of the impacts of thermomechanical loading of potential host rock within the Yucca Mountain Site Characterization Project. Representative intact rock and joint mechanical properties were selected for welded and nonwelded tuffs from the currently available data sources. Rock mass qualities were then estimated using both the Norwegian Geotechnical Institute (Q) and Geomechanics Rating (RMR) systems. Rock mass mechanical properties were developed based on estimates of rock mass quality, the current knowledge of intact properties, and fracture/joint characteristics. Empirical relationships developed to correlate the rock mass quality indices and the rock mass mechanical properties were then used to estimate the range of rock mass mechanical properties.

32475 (SAND–92-0960) **Initial field testing definition of subsurface sealing and backfilling tests in unsaturated tuff: Yucca Mountain Site Characterization Project.** Fernandez, J.A. (Sandia National Labs., Albuquerque, NM (United States)); Case, J.B.; Tyburski, J.R. Sandia National Labs., Albuquerque, NM (United States). May 1993. 393p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018523. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains an initial definition of the field tests proposed for the Yucca Mountain Project repository sealing program. The tests are intended to resolve various performance and emplacement concerns. Examples of concerns to be addressed include achieving selected hydrologic and structural requirements for seals, removing portions of the shaft liner, excavating keyways, emplacing cementitious and earthen seals, reducing the impact of fines on the hydraulic conductivity of fractures, efficient grouting of fracture zones, sealing of exploratory boreholes, and controlling the flow of water by using engineered designs. Ten discrete tests are proposed to address these and other concerns. These tests are divided into two groups: Seal component tests and performance confirmation tests. The seal component tests are thorough small-scale in situ tests, the intermediate-scale borehole seal tests, the fracture grouting tests, the surface backfill tests, and the grouted rock mass tests. The seal system tests are the seepage control tests, the backfill tests, the bulkhead test in the Calico Hills unit, the large-scale shaft seal and shaft fill tests, and the remote borehole sealing tests. The tests are proposed to be performed in six discrete areas, including welded and non-welded environments, primarily located outside the potential repository area. The final selection of sealing tests will depend on the nature of the geologic and hydrologic conditions encountered during the development of the Exploratory Studies Facility and detailed numerical analyses. Tests are likely to be performed both before and after License Application.

32476 (SAND–92-2334) **Preclosure radiological safety evaluation: Exploratory Studies Facility: Yucca Mountain Site Characterization Project.** Schelling, F.J. (Sandia National Labs., Albuquerque, NM (US)); Smith, J.D. Sandia National Labs., Albuquerque, NM (United States). Jul 1993. 52p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018679. Source: OSTI; NTIS; INIS; GPO Dep.

A radiological safety evaluation is performed to determine the impacts of Exploratory Studies Facility (ESF) design changes on the preclosure public radiological safety for a potential nuclear waste repository at Yucca Mountain, Nevada. Although the ESF design

has undergone significant modification, incorporation of the modified design requires only modest changes to the conceptual repository configuration. To the extent feasible, the results of earlier safety evaluations presented in SAND84-2641, SAND88-7061, and SAND89-7024, which were based on the original ESF configuration, are compared with the results for the modified configuration. This comparison provides an estimate of the range of analysis uncertainty. This preliminary analysis indicates that there are no Q-scenarios, which are defined as those scenarios with a net occurrence probability of greater than 10^{-6}/yr and produce a radiological dose at the 5-km controlled area boundary of greater than 0.5 rem. The analysis yielded estimates for an underground accident of a probability of 3.8×10^{-15}/yr and a dose of 1.5 rem. For a surface-initiated accident, a probability of 1.5×10^{-12}/yr and a dose of 0.6 rem was estimated.

32477 (SAND–92-2431) **Review of radionuclide source terms used for performance-assessment analyses: Yucca Mountain Site Characterization Project.** Barnard, R.W. Sandia National Labs., Albuquerque, NM (United States). Jun 1993. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018681. Source: OSTI; NTIS; INIS; GPO Dep.

Two aspects of the radionuclide source terms used for total-system performance assessment (TSPA) analyses have been reviewed. First, a detailed radionuclide inventory (i.e., one in which the reactor type, decay, and burnup are specified) is compared with the standard source-term inventory used in prior analyses. The latter assumes a fixed ratio of pressurized-water reactor (PWR) to boiling-water reactor (BWR) spent fuel, at specific amounts of burnup and at 10-year decay. TSPA analyses have been used to compare the simplified source term with the detailed one. The TSPA-91 analyses did not show a significant difference between the source terms. Second, the radionuclides used in source terms for TSPA aqueous-transport analyses have been reviewed to select ones that are representative of the entire inventory. It is recommended that two actinide decay chains be included (the 4n+2 "uranium" and 4n+3 "actinium" decay series), since these include several radionuclides that have potentially important release and dose characteristics. In addition, several fission products are recommended for the same reason. The choice of radionuclides should be influenced by other parameter assumptions, such as the solubility and retardation of the radionuclides.

32478 (SAND–92-2762) **Use of the iterative solution method for coupled finite element and boundary element modeling: Yucca Mountain Site Characterization Project.** Koteras, J.R. Sandia National Labs., Albuquerque, NM (United States). Jul 1993. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018682. Source: OSTI; NTIS; INIS; GPO Dep.

Tunnels buried deep within the earth constitute an important class geomechanics problems. Two numerical techniques used for the analysis of geomechanics problems, the finite element method and the boundary element method, have complementary characteristics for applications to problems of this type. The usefulness of combining these two methods for use as a geomechanics analysis tool has been recognized for some time, and a number of coupling techniques have been proposed. However, not all of them lend themselves to efficient computational implementations for large-scale problems. This report examines a coupling technique that can form the basis for an efficient analysis tool for large scale geomechanics problems through the use of an iterative equation solver.

32479 (SAND–92-7291) **Creep tests on clean and argillaceous salt from the Waste Isolation Pilot Plant.** Mellegard, K.D. (RE/SPEC Inc., Rapid City, SD (US)); Pfeifle, T.W. Sandia National Labs., Albuquerque, NM (United States); RE/SPEC, Inc., Rapid City, SD (United States). May 1993. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018502. Source: OSTI; NTIS; INIS; GPO Dep.

Fifteen triaxial compression creep tests were performed on clean and argillaceous salt from the Waste Isolation Pilot Plant (WIPP). The temperatures in the tests were either 25°C or 100°C while the stress difference ranged from 3.5 MPa to 21.0 MPa. In all tests, the confining pressure was 15 MPa. Test duration ranged from 23 to 613 days with an average duration of 300 days. The results of the creep tests supplemented earlier testing and were used to estimate two parameters in the Modified Munson-Dawson constitutive law for the creep behavior of salt. The two parameters determined from each test were the steady-state strain rate and the transient strain limit. These estimates were combined with parameter estimates determined from previous testing to study the dependence of both transient and steady-state creep deformation on stress difference. The exponents on stress difference determined in this study were found to be consistent with revised estimates of the exponents reported by other investigators.

32480 (SAND–92-7340) **Seal design alternatives study.** Van Sambeek, L.L. (RE/SPEC Inc., Rapid City, SD (US)); Luo, D.D.; Lin, M.S.; Ostrowski, W.; Oyenuga, D. Sandia National Labs., Albuquerque, NM (United States); RE/SPEC, Inc., Rapid City, SD (United States); Parsons, Brinckerhoff, Quade and Douglas, Inc., San Francisco, CA (United States). Jun 1993. 201p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018684. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the results from a study of various sealing alternatives for the WIPP sealing system. Overall, the sealing system has the purpose of reducing to the extent possible the potential for fluids (either gas or liquid) from entering or leaving the repository. The sealing system is divided into three subsystems: drift and panel seals within the repository horizon, shaft seals in each of the four shafts, and borehole seals. Alternatives to the baseline configuration for the WIPP seal system design included evaluating different geometries and schedules for seal component installations and the use of different materials for seal components. Order-of-magnitude costs for the various alternatives were prepared as part of the study. Firm recommendations are not presented, but the advantages and disadvantages of the alternatives are discussed. Technical information deficiencies are identified and studies are outlined which can provide required information.

32481 (SAND–93-0729) **Concepts for operational period panel seal design at the Waste Isolation Pilot Plant.** Hansen, F.D. (Sandia National Labs., Albuquerque, NM (United States)); Lin, M.S.; Van Sambeek, L.L. Sandia National Labs., Albuquerque, NM (United States). Jul 1993. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93019211. Source: OSTI; NTIS; INIS; GPO Dep.

Concepts for underground panel or drift seals at the Waste Isolation Pilot Plant are developed to satisfy sealing requirements of the operational period. The concepts are divided into two groups. In the "NOW" group, design concepts are considered in which a sleeve structure is installed in the panel access immediately after excavation and before waste is emplaced. In the "LATER" group, no special measures are taken during excavation or before waste emplacement; the seal is installed at a later date, perhaps up to 35 years after the drift is excavated. Three concepts are presented in both the NOW and LATER groups. A rigid sleeve, a yielding sleeve, and steel rings with inflatable tubes are proposed as NOW concepts. One steel ring concept and two concrete monoliths are proposed for seals emplaced in older drifts. Advantages and disadvantages are listed for each concept. Based on the available information, it appears most feasible to recommend a LATER concept using a concrete monolith as a preferred seal for the operational period. Each concept includes the potential of remedial grout and/or construction of a chamber that could be used for monitoring leakage from a closed panel during the operational period. Supporting in situ demonstrations of elements of the concepts are recommended.

32482 (SAND–93-1055) **Waste Isolation Pilot Plant Materials Interface Interactions Test: Papers presented at the Commission of European Communities workshop on in situ testing of radioactive waste forms and engineered barriers.** Molecke, M.A. (Sandia National Labs., Albuquerque, NM (US)); Sorensen, N.R. (eds.); Wicks, G.G. (ed.). Sandia National Labs., Albuquerque, NM (United States). Aug 1993. 72p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93040210. Source: OSTI; NTIS; INIS; GPO Dep.

The three papers in this report were presented at the second international workshop to feature the Waste Isolation Pilot Plant (WIPP) Materials Interface Interactions Test (MIIT). This Workshop on In Situ Tests on Radioactive Waste Forms and Engineered Barriers was held in Corsendonk, Belgium, on October 13–16, 1992, and was sponsored by the Commission of the European Communities (CEC). The Studiecentrum voor Kernenergie/Centre D'Energie Nucleaire (SCK/CEN, Belgium), and the US Department of Energy (via Savannah River) also cosponsored this workshop. Workshop participants from Belgium, France, Germany, Sweden, and the United States gathered to discuss the status, results and overviews of the MIIT program. Nine of the twenty-five total workshop papers were presented on the status and results from the WIPP MIIT program after the five-year in situ conclusion of the program. The total number of published MIIT papers is now up to almost forty. Posttest laboratory analyses are still in progress at multiple participating laboratories. The first MIIT paper in this document, by Wicks and Molecke, provides an overview of the entire test program and focuses on the waste form samples. The second paper, by Molecke and Wicks, concentrates on technical details and repository relevant observations on the in situ conduct, sampling, and termination operations of the MIIT. The third paper, by Sorensen and Molecke, presents and summarizes the available laboratory, posttest corrosion data and results for all of the candidate waste container or overpack metal specimens included in the MIIT program.

32483 (SAND–93-1135C) **Room closure response to gas generation and mechanical strength of different waste forms in a bedded salt repository.** Mendenhall, F.T.; Stone, C.M. Sandia National Labs., Albuquerque, NM (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-931108–1: Fall meeting of the Materials Research Society, Boston, MA (United States), 29 Nov - 3 dec 1993). Order Number DE93013757. Source: OSTI; NTIS; INIS; GPO Dep.

Finite element calculations of the porosity history of a nuclear waste disposal room in a bedded salt formation have been completed. The analyses include an elastic/secondary creep model for the host halite and a nonlinear consolidation model for the crushed salt backfill. Separate gas generation and constitutive models were used for three distinct waste forms, (1) unaltered defense related CH-TRU waste, (2) shredded and cemented CH-TRU waste, and (3) incinerated and vitrified CH-TRU waste. Solutions were determined for a 2000 year time period starting from the decommissioning of the repository. The resulting room porosities varied from roughly 55% to less than 10%.

32484 (SAND–93-1348C) **Reconsolidation of salt as applied to permanent seals for the Waste Isolation Pilot Plant.** Hansen, F.D. (Sandia National Labs., Albuquerque, NM (United States)); Callahan, G.D.; Van Sembeek, L.L. Sandia National Labs., Albuquerque, NM (United States). [1993]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9309205–2: 3. conference on the mechanical behavior of salt, Paliseau (France), 14-16 Sep 1993). Order Number DE93017494. Source: OSTI; NTIS; INIS; GPO Dep.

Reconsolidated salt is a fundamental component of the permanent seals for the Waste Isolation Pilot Plant. As regulations are currently understood and seal concepts envisioned, emplaced salt is the sole long-term seal component designed to prevent the shafts from becoming preferred pathways for rating gases or liquids. Studies under way in support of the sealing function of emplaced salt include laboratory testing of crushed salt small-scale in situ tests, constitutive modeling of crushed salt, calculations of the opening responses during operation and closure, and design practicalities including emplacement techniques. This paper briefly summarizes aspects of these efforts and key areas of future work.

32485 (SAND–93-1415C) **Analysis of releases due to drilling at the potential Yucca Mountain repository.** Barnard, R.W. Sandia National Labs., Albuquerque, NM (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-931160–8: American Nuclear Society (ANS) winter meeting, San Francisco, CA (United States), 14-19 Nov 1993). Order Number DE93017656. Source: OSTI; NTIS; INIS; GPO Dep.

Human Instrusion into the potential repository at Yucca Mountain, Nevada, was modeled in the Total-System Performance Assessment ("TSPA-91") recently completed for the Yucca Mountain Site Characterization Project Office of the DOE. The scenario model assumed that the repository would be penetrated at random locations by a number of boreholes drilled using twentieth-century rotary drilling techniques.

32486 (SAND–93-7019) **Properties of salt-saturated concrete and grout after six years in situ at the Waste Isolation Pilot Plant.** Wakeley, L.D. (Army Engineer Waterways Experiment Station, Vicksburg, MS (United States). Structures Lab.); Harrington, P.T.; Weiss, C.A. Jr. Sandia National Labs., Albuquerque, NM (United States); Army Engineer Waterways Experiment Station, Vicksburg, MS (United States). Structures Lab. Jun 1993. 62p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018444. Source: OSTI; NTIS; INIS; GPO Dep.

Samples of concrete and grout were recovered from short boreholes in the repository floor at the Waste Isolation Pilot Plant more than six years after the concrete and grout were placed. Plugs from the Plug Test Matrix of the Plugging and Sealing Program of Sandia National Laboratories were overcored to include a shell of host rock. The cores were analyzed at the Waterways Experiment Station to assess their condition after six years of service, having potentially been exposed to those aspects of their service environment (salt, brine, fracturing, anhydrite, etc.) that could cause deterioration. Measured values of compressive strength and pulse velocity of both the grout and the concrete equaled or exceeded values from tests performed on laboratory-tested samples of the same mixtures at ages of one month to one year after casting. The phase assemblages had changed very little. Materials performed as intended and showed virtually no chemical or physical evidence of deterioration. The lowest values for strength and pulse velocity were measured for samples taken from the Disturbed Rock Zone, indicating the influence of cracking in this zone on the properties of enclosed seal materials. There was evidence of movement of brine in the system. Crystalline phases containing magnesium, potassium, sulfate, and other ions had been deposited on free surfaces in fractures and pilot holes. There was a reaction rim in the anhydrite immediately surrounding each recovered borehole plug, suggesting interaction between grout or concrete and host rock. However, the chemical changes apparent in this reaction rim were not reflected in the chemical composition of the adjacent concrete or grout. The grout and concrete studied here showed no signs of the deterioration found to have occurred in some parts of the concrete liner of the Waste Isolation Pilot Plant waste handling shaft.

32487 (SR/H–613) **Energy conservation and incinerators.** Monroe, E.S. Du Pont de Nemours (E.I.) and Co., Wilmington, DE (United States). Engineering Dept. Jun 1981. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. Order Number DE93019315. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report discusses the proper selection of equipment for incinerating wastes and its operation which can play a major factor in reducing energy costs. Emphasis is placed upon utilizing existing boilers where it is feasible.

32488 (SR/H–615) **Report on survey of incinerator facilities at four ERDA sites.** Spencer, C.D. Savannah River Lab., Aiken, SC (United States). 14 Oct 1975. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. Order Number DE93019313. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of this survey was to visit incinerator facilities at four selected sites representing diverse processes. The four sites are: Mounds Laboratory; Rocky Flats Plant; Battelle Pacific Northwest Laboratory; and Atlantic Richfield Hanford Company. An attempt was made to review design, operation and maintenance experience with site personnel. Judgments were made regarding processing approach and systems equipment for best handling the alpha waste at the rates generated at Savannah River Plant. This report contains significant details for each site visited, including personnel visited, a description of facilities and appraisals of advantages and disadvantages of each. The incinerating facilities

viewed at the four sites represented a wide diversity of approaches to handling solid radioactive waste materials. Although there are differences in tasks associated with some of the concepts, it appeared that diversity is more the result of individual design approaches. This, in turn, reflects the state of this technology; there are no proven complete systems that are sufficiently attractive to be considered acceptable for general AE industry use.

32489 (UCRL-ID–112283) **FY 1992 Annual report: Mediated electrochemical oxidation treatment for Rocky Flats combustible low-level mixed waste: Final report to Rocky Flats Plant.** Chiba, Z.; Lewis, P.R.; Kahle, R.W. Lawrence Livermore National Lab., CA (United States). Mar 1993. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93018496. Source: OSTI; NTIS; INIS; GPO Dep.

The Mediated Electrochemical Oxidation (MEO) process was studied for destroying low-level combustible mixed wastes at Rocky Flats (RFP). Tests were performed with nonradioactive surrogate materials: Trimsol for the contaminated oils, and reagent-grade cellulose for the cellulosic wastes. Extensive testing was carried out on Trimsol in both small laboratory-scale apparatus and on a large-scale system incorporating an industrial-size electrochemical cell. Preliminary tests were also carried out in the small-scale system with cellulose. The following operating and system parameters were studied: use of a silver-nitric acid versus a cobalt-sulfuric acid system, effect of electrolyte temperature, effect of acid concentration, effect of current density, and use of ultrasonic agitation. Destruction and coulombic efficiencies were calculated using data obtained from continuous carbon dioxide monitors and total organic carbon (TOC) analysis of electrolyte samples. For Trimsol, the best performance was achieved with the silver-nitrate system at high acid concentrations, temperatures, and current densities. Destruction efficiencies of 98% or greater and coulombic efficiencies close to 50% were obtained in both small- and large-scale systems. For the cellulose, high destruction efficiencies and reasonable coulombic efficiencies were obtained for both silver-nitrate and cobalt-sulfate systems.

32490 (UCRL-ID–112284) **Incineration alternatives for combustible waste ultraviolet/hydrogen peroxide process: Annual report, FY 1992.** Wang, F.; Cassidy, K.; Lum, B. Lawrence Livermore National Lab., CA (United States). Mar 1993. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93018905. Source: OSTI; NTIS; GPO Dep.

We have demonstrated that the ultraviolet light/hydrogen peroxide (UV/H_2O_2 process is capable of completely destroying liquid and solid organic wastes. Using the UV/H_2O_2 process, we destroyed two liquid wastes: ethylene glycol (water-soluble) and Trimsol (water-dispersible), and two solid wastes: sodium salts of carboxymethylcellulose (water-soluble) and powdered fibrous cellulose (water-insoluble cellulose). We have found that Fenton's reagent is needed to treat fibrous cellulose effectively and that water-soluble nonhalogenated organic compounds can be treated effectively by adding only H_2O_2 to the process. For water-dispersible and solid organic compounds, maintaining an emulsified condition and having a large reaction surface area are necessary for successful destruction of organics by the UV/H_2O_2 process. Conditions (e.g. pH, temperature, feeding rate of H_2O_2, etc.) for maximum efficiency of organic compound destruction have been identified during careful, parametric investigations.

32491 (UCRL-ID–113383) **Chemical and mineralogical concerns for the use of man-made materials in the post-emplacement environment.** Meike, A. Lawrence Livermore National Lab., CA (United States). 16 Jan 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93019212. Source: OSTI; NTIS; INIS; GPO Dep.

In a radioactive waste repository, materials will be introduced for a variety of reasons. Some materials such as metals, bonding agents, and concrete will serve as active parts of the designed engineered barrier system (EBS). Other materials will be introduced to serve a number of purposes that include any or all of the following: surveillance (thermocouples, gauges), construction and operation (drilling rigs, roadbeds, exhaust fumes, chemical toilets, concrete, grout, rebar), lubrication (petroleum-based products, rope dressing) and other functions. Water chemistry will directly affect the corrosion of containers, the dissolution of spent fuel and waste glass and the concentration of dissolved or suspended radionuclides in water that exits breached containers. To predict the water quality requires a knowledge of the dissolution kinetics of the phases present in man-made materials, and the precipitation kinetics of product phases. The chemical evolution of man-made materials of interest to the Yucca Mountain project are by and large not presently known. Prediction of the long-term behavior (10,000 years) required of the modeling efforts is an additional layer of complexity that is not addressed by current models of water chemistry. Man-made modifications to the environment may significantly alter the thermal, chemical and radionuclide transportation attributes of the natural environment that are presently being considered in order to determine a waste package design. The specific chemical concerns addressed here are: solubility and stability of solid phases; liquid and gas phase stability; long term effects; radiolysis effects; colloids; and interactions between man-made material, rock, and J-13 or concentrated J-13 water. The report concludes with recommendations.

32492 (UCRL-JC–112666) **Molten salt destruction process for mixed wastes.** Upadhye, R.S.; Wilder, J.G.; Karlsen, C.E. Lawrence Livermore National Lab., CA (United States). Apr 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930873–21: 2. international mixed waste symposium, Baltimore, MD (United States), 17-20 Aug 1993). Order Number DE93018641. Source: OSTI; NTIS; INIS; GPO Dep.

We are developing an advanced two-stage process for the treatment of mixed wastes, which contain both hazardous and radioactive components. The wastes, together with an oxidant gas, such as air, are injected into a bed of molten salt comprising a mixture of sodium-, potassium-, and lithium-carbonates, with a melting point of about 580°C. The organic constituents of the mixed waste are destroyed through the combined effect of pyrolysis and oxidation. Heteroatoms. such as chlorine, in the mixed waste form stable salts, such as sodium chloride, and are retained in the melt. The radioactive actinides in the mixed waste are also retained in the melt because of the combined action of wetting and partial dissolution. The original process, consists of a one-stage unit, operated at 900–1000°C. The advanced two-stage process has two stages, one for pyrolysis and one for oxidation. The pyrolysis stage is designed to operate at 700°C. The oxidation stage can be operated at a higher temperature, if necessary.

32493 (UCRL-JC–112669) **Mediated electrochemical oxidation of mixed wastes.** Chiba, Z. Lawrence Livermore National Lab., CA (United States). Apr 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930873–24: 2. international mixed waste symposium, Baltimore, MD (United States), 17-20 Aug 1993). Order Number DE93019145. Source: OSTI; NTIS; INIS; GPO Dep.

The Mediated Electrochemical Oxidation (MEO) process was studied for destroying low-level combustible mixed wastes at Rocky Flats Plant. Tests were performed with non-radioactive surrogate materials: Trimsol for contaminated cutting oils, and reagent-grade cellulose for contaminated cellulosic wastes. Extensive testing was carried out on Trimsol in both small laboratory-scale apparatus and on a large-scale system incorporating an industrial-size electrochemical cell. Preliminary tests were also carried out in the small-scale system with cellulose. Operating and system parameters that were studied were: use of a silver-nitric acid versus a cobalt-sulfuric acid system, effect of electrolyte temperature, effect of acid concentration, and effect of current density. Destruction and coulombic efficiencies were calculated using data obtained from continuous carbon dioxide monitors and total organic carbon (TOC) analysis of electrolyte samples. For Trimsol, the best performance was achieved with the silver-nitrate system at high acid concentrations, temperatures, and current densities. Destruction efficiencies of 99% or greater, and coulombic efficiencies up to 70% were

obtained. For the cellulose, high destruction efficiencies and reasonable coulombic efficiencies were obtained for both silver-nitrate and cobalt-sulfate systems.

32494 (UCRL-JC–112670) **Mixed Waste Management Facility.** Brummond, W.; Celeste, J.; Steenhoven, J. Lawrence Livermore National Lab., CA (United States). Aug 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930873–23: 2. international mixed waste symposium, Baltimore, MD (United States), 17-20 Aug 1993). Order Number DE93018625. Source: OSTI; NTIS; INIS; GPO Dep.

The DOE has developed a National Mixed Waste Strategic Plan which calls for the construction of 2 to 9 mixed waste treatment centers in the Complex in the near future. LLNL is working to establish an integrated mixed waste technology development and demonstration system facility, the Mixed Waste Management Facility (MWMF), to support the DOE National Mixed Waste Strategic Plan. The MWMF will develop, demonstrate, test, and evaluate incinerator-alternatives which will comply with regulations governing the treatment and disposal of organic mixed wastes. LLNL will provide the DOE with engineering data for design and operation of new technologies which can be implemented in their mixed waste treatment centers. MWMF will operate under real production plant conditions and process samples of real LLNL mixed waste. In addition to the destruction of organic mixed wastes, the development and demonstration will include waste feed preparation, material transport systems, aqueous treatment, off-gas treatment, and final forms, thus making it an integrated "cradle to grave" demonstration. Technologies from offsite as well as LLNL's will be tested and evaluated when they are ready for a pilot scale demonstration, according to the needs of the DOE.

32495 (UCRL-JC–113555) **Using value engineering to facilitate PWAs.** Sperling, R.B. Lawrence Livermore National Lab., CA (United States). 19 Mar 1993. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9303209–1: Department of Energy (DOE) defence programs pollution prevention and integrated technologies workshop, Santa Fe, NM (United States), 30 Mar 1993). Order Number DE93018640. Source: OSTI; NTIS; INIS; GPO Dep.

Value Engineering (VE) is a problem solving methodology that has been used in manufacturing and construction industries for fifty years to improve products, systems and projects while reducing unnecessary cost. A Process Waste Assessment (PWA) is a newly developed methodology designed to characterize waste streams and identify opportunities to reduce or eliminate waste generation. The VE and PWA methodologies are compared to show their general similarities and specific differences, and to suggest how VE can be woven into the PWA methodology. Further, the roles of the VE and PWA team leaders and their training are compared; suggestions are made to help enable the PWA team leader to more effectively lead a group-centered creative process. Examples of how VE has been used in hazardous and radioactive waste minimization and pollution prevention projects are presented, also.

32496 (WHC-EP–0182-60) **Tank Farm surveillance and waste status summary report for March 1993.** Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). May 1993. 114p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018060. Source: OSTI; NTIS; INIS; GPO Dep.

This report is the official inventory for radioactive waste stored in underground tanks in the 200 Areas at the Hanford Site. Data that depict the status of stored radioactive waste and tank vessel integrity are Contained within the report. This report provides data on each of the existing 177 large underground waste storage tanks and 49 smaller catch tanks and special surveillance facilities, and supplemental information regarding flank surveillance anomalies and ongoing investigations. This report is intended to meet the requirement of US Department of Energy-Richland Operations Office order 5820.2A, Chapter I, Section 3.e. (3) (DOE-RL, 1990, Radioactive Waste Management, US Department of Energy-Richland Operation Office, Richland, Washington) requiring the reporting of waste inventories and space utilization for Hanford Tank Farm Tanks.

32497 (WHC-EP–0182-61) **Tank Farm surveillance and waste status summary report for April 1993.** Hanlon, B.M. Westinghouse Hanford Co., Richland, WA (United States). Jul 1993. 112p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018064. Source: OSTI; NTIS; INIS; GPO Dep.

This report is the official inventory for radioactive waste stored in underground tanks in the 200 Areas at the Hanford Site. Data that depict the status of stored radioactive waste and tank vessel integrity are contained within the report. This report provides data on each of the existing 177 large underground waste storage tanks and 49 smaller catch tanks and special surveillance facilities, and supplemental information regarding tank surveillance anomalies and ongoing investigations.

32498 (WHC-EP–0522) **Hanford Waste Vitrification Plant Project Waste Form Qualification Program Plan.** Randklev, E.H. Westinghouse Hanford Co., Richland, WA (United States). Jun 1993. 146p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018736. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy has created a waste acceptance process to help guide the overall program for the disposal of high-level nuclear waste in a federal repository. This Waste Form Qualification Program Plan describes the hierarchy of strategies used by the Hanford Waste Vitrification Plant Project to satisfy the waste form qualification obligations of that waste acceptance process. A description of the functional relationship of the participants contributing to completing this objective is provided. The major activities, products, providers, and associated scheduling for implementing the strategies also are presented.

32499 (WHC-EP–0567-1) **1993 Solid Waste Reference Forecast Summary.** Valero, O.J. (Westinghouse Hanford Co., Richland, WA (United States)); Blackburn, C.L.; Kaae, P.S.; Armacost, L.L.; Garrett, S.M.K. Westinghouse Hanford Co., Richland, WA (United States); Pacific Northwest Lab., Richland, WA (United States). Aug 1993. 118p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93019494. Source: OSTI; NTIS; INIS; GPO Dep.

This report, which updates WHC-EP-0567, 1992 Solid Waste Reference Forecast Summary, (WHC 1992) forecasts the volumes of solid wastes to be generated or received at the US Department of Energy Hanford Site during the 30-year period from FY 1993 through FY 2022. The data used in this document were collected from Westinghouse Hanford Company forecasts as well as from surveys of waste generators at other US Department of Energy sites who are now shipping or plan to ship solid wastes to the Hanford Site for disposal. These wastes include low-level and low-level mixed waste, transuranic and transuranic mixed waste, and nonradioactive hazardous waste.

32500 (WHC-EP–0599) **The role of aging in resolving the ferrocyanide safety issue.** Babad, H.; Meacham, J.E.; Simpson, B.C.; Cash, R.J. Westinghouse Hanford Co., Richland, WA (United States). Aug 1993. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93040338. Source: OSTI; NTIS; INIS; GPO Dep.

A chemical process called aging, in which stored ferrocyanide waste could be dissolved and dispersed among waste tanks, or destroyed by radiolysis and hydrolysis, has been proposed at the Hanford Site. This paper summarizes the results of applied research, characterization, and modeling activities on Hanford Site ferrocyanide waste material that support the existence of a chemical aging mechanism. Test results from waste simulants and actual waste tank materials are presented and compared with theoretical estimates. Chemical and energetic behavior of the materials are the key indicators of destruction or dispersion. Screening experiments on vendor-prepared sodium nickel ferrocyanide and the initial results from core sampling support the concept that aging of ferrocyanide is taking place in the waste tanks at the Hanford Site. This report defines the concept of waste aging and explains the role that aging could play in resolving the Hanford Site ferrocyanide safety issue.

32501 (WHC-EP–0626) **Material-not-categorized-as-waste survey for 1992.** Jacobsen, P.H. Westinghouse Hanford Co., Richland, WA (United States). Jul 1993. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93019492. Source: OSTI; NTIS; INIS; GPO Dep.

In October 1992, the US Department of Energy, Richland Field Office (RL) requested that Westinghouse Hanford Company (WHC) respond to a letter from EM-331 asking for completion of a survey of items in storage but not categorized as waste (Roberts 1992). The letter contained an attachment with instructions on how to fill out the attached form and what to exclude from the survey (Appendix A). This report is a summary of the information from the response issued to RL. This report primarily is for use in estimating future waste volumes that may have been overlooked because of the nature of their classification as material not categorized as waste (MNCAW) (i.e., not yet declared Waste).

32502 (WHC-EP–0629) **Pretreatment Technology Plan.** Barker, S.A. (Westinghouse Hanford Co., Richland, WA (US)); Thornhill, C.K.; Holton, L.K. Jr. Westinghouse Hanford Co., Richland, WA (United States). Mar 1993. 138p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018061. Source: OSTI; NTIS; INIS; GPO Dep.

This technology plan presents a strategy for the identification, evaluation, and development of technologies for the pretreatment of radioactive wastes stored in underground storage tanks at the Hanford Site. This strategy includes deployment of facilities and process development schedules to support the other program elements. This document also presents schedule information for alternative pretreatment systems: (1) the reference pretreatment technology development system, (2) an enhanced pretreatment technology development system, and (3) alternative pretreatment technology development systems.

32503 (WHC-EP–0640) **Tank characterization data report: Tank 241-C-112.** Simpson, B.C.; Borsheim, G.L.; Jensen, L. Westinghouse Hanford Co., Richland, WA (United States). Apr 1993. 205p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018062. Source: OSTI; NTIS; INIS; GPO Dep.

Tank 241-C-112 is a Hanford Site Ferrocyanide Watch List tank that was most recently sampled in March 1992. Analyses of materials obtained from tank 241-C-112 were conducted to support the resolution of the Ferrocyanide Unreviewed Safety Question (USQ) and to support Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement) Milestone M-10-00. Analysis of core samples obtained from tank 241-C-112 strongly indicates that the fuel concentration in the tank waste will not support a propagating exothermic reaction. It is probable that tank 241-C-112 exceeds the 1,000 g-mol inventory criteria established for the Ferrocyanide USQ; however, extensive energetic analysis of the waste has determined a maximum exothermic value of -9 cal/g dry waste. This value is substantially below any levels of concern (-75 cal/g). In addition, an investigation of potential mechanisms to generate concentration levels of radionuclides high enough to be of concern was performed. No credible mechanism was postulated that could initiate the formation of such concentration levels in the tank. Tank 241-C-112 waste is a complex material made up primarily of water and inert salts. The insoluble solids are a mixture of phosphates, sulfates, and hydroxides in combination with aluminum, calcium, iron, nickel, and uranium. Disodium nickel ferrocyanide and sodium cesium nickel ferrocyanide probably exist in the tank; however, there appears to have been significant degradation of this material since the waste was initially settled in the tank.

32504 (WHC-EP–0644) **Long-Term Climate Change Assessment Task for the Hanford Site Permanent Isolation Barrier Development Program: Status through FY 1992.** Petersen, K.L. (Westinghouse Hanford Co., Richland, WA (US)); Chatters, J.C. Westinghouse Hanford Co., Richland, WA (United States). Jul 1993. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018501. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Site Permanent Isolation Barrier Development Program (Barrier Development Program) was organized (Adams and Wing 1986) to develop the technology needed to provide an in-place disposal capability for the US Department of Energy at the Hanford Site in southeastern Washington. The goals of the Barrier Development Program are to provide defensible evidence that final barrier design(s) will adequately control water infiltration, plant and animal intrusion, and wind and water erosion for a minimum of 1,000 years; to isolate wastes from the accessible environment; and to use markers to warn inadvertent human intruders. Evidence for barrier performance will be obtained by conducting laboratory experiments, field tests, computer modeling, and other studies that establish confidence in the barrier's ability to meet its 1,000-year design life. The performance and stability of natural barrier analogs that have existed for several millennia and the reconstruction of climate changes during the past 10,000 to 125,000 years also will provide insight into bounding conditions of possible future changes and increase confidence in the barriers design. In the following discussion the term "long-term" references periods of time up to 1000's of years, distinguishing it from "short-term" weather patterns covering a decade or less. Specific activities focus on planning and conducting a series of studies and tests required to confirm key aspects of the barrier design. The effort is a collaborative one between scientists and engineers from Westinghouse Hanford Company (Westinghouse Hanford) and Pacific Northwest Laboratory (PNL) to design barriers to limit movement of radionuclides and other contaminants to the accessible environment for at least 1,000 years. These activities have been divided into 14 groups of tasks that aid in the complete development of protective barrier and warning marker system.

32505 (WHC-EP–0651) **Barometric pressure variations.** Crippen, M.D. Westinghouse Hanford Co., Richland, WA (United States). Jun 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93019122. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents Hanford Site barometric data that can be used to determine the breathing rate of Hanford Site tanks and details the derivation of the data. The barometric pressure data recorded at the Hanford Weather Station were used for this analysis. Data for 1988, 1989, 1990, and 1991 were used.

32506 (WHC-EP–0660) **Nondestructive testing methods for 55-gallon, waste storage drums.** Ferris, R.H. (Pacific Northwest Lab., Richland, WA (United States)); Hildebrand, B.P.; Hockey, R.L.; Riechers, D.M.; Spanner, J.C.; Duncan, D.R. Westinghouse Hanford Co., Richland, WA (United States). Jun 1993. 83p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93019130. Source: OSTI; NTIS; INIS; GPO Dep.

The Westinghouse Hanford Company (WHC) authorized Pacific Northwest Laboratory (PNL) to conduct a feasibility study to identify promising nondestructive testing (NDT) methods for detecting general and localized (both pitting and pinhole) corrosion in the 55-gal drums that are used to store solid waste materials at the Hanford Site. This document presents results obtained during a literature survey, identifies the relevant reference materials that were reviewed, provides a technical description of the methods that were evaluated, describes the laboratory tests that were conducted and their results, identifies the most promising candidate methods along with the rationale for these selections, and includes a work plan for recommended follow-on activities. This report contains a brief overview and technical description for each of the following NDT methods: magnetic testing techniques; eddy current testing; shearography; ultrasonic testing; radiographic computed tomography; thermography; and leak testing with acoustic detection.

32507 (WHC-EP–0661) **Summary report on parametric pressure propagation test T0127-1.** Fauske, H.K. (Fauske and Associates, Inc., Burr Ridge, IL (US)). Westinghouse Hanford Co., Richland, WA (United States). Jun 1993. 101p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018059. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the results of two ferrocyanide propagating reaction generated aerosol tests, conducted as a part of a series of tests directed by Westinghouse Hanford Company (WHC). The tests discussed in this document are designated as T0208-1 and

T0209-1. The tests were carried out in a 49 L containment volume equipped with an aerosol filter housing. The test setup is described in Section 2.0. Each test used an ≈ 50 gm. sample of InFarm-1 bottom flow sheet material which was vacuum dried, screened through a 140 mesh sieve, and rehydrated to 1 wgt. % water content prior to testing. The test sample and reaction ignition method are described in Section 3.0. A special test protocol was defined and followed for the tests as described in Section 4.0 and Appendix B. Test results are discussed in Section 5.0. Both tests yielded a significant aerosol sample on the filter element. These filter elements and aerosol deposits have been sent to WHC for analysis, and any information as to the content or chemical composition of the trapped particulate material awaits the results of WHC efforts in this regard. The reaction propagation tests were conducted at 60°C and 120°C respectively. The average propagation velocities are consistent with other related observations.

32508 (WHC-EP–0662) **Summary report on 49 L ferrocyanide aerosol tests TO208-1 and TO209-1.** Fauske, H.K. (Fauske and Associates, Inc., Burr Ridge, IL (United States)). Westinghouse Hanford Co., Richland, WA (United States); Fauske and Associates, Inc., Burr Ridge, IL (United States). Jun 1993. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93040339. Source: OSTI; NTIS; GPO Dep.

This report presents the results of the first test conducted in a series of tests directed by Westinghouse Hanford Company (WHC). For the record, Ref.[l] is included as Appendix A. The test discussed in this document, designated as T0127-1, is a ferrocyanide reaction propagation rate determination test conducted under an inert argon atmosphere of 10 atm. abs. (130 psig). The test was conducted in a new 49 L containment volume described in Section 2.0. The test sample was dry In-Farm 1 bottom flow sheet material. The test protocol was similar to that described in Refs.[2 and 3]. However, as requested in Ref.[l] supplemental gas sample taking procedures were prepared and followed as described in Section 4.0 and Appendix B. Test results shoved an inverse reaction propagation velocity of ≈4 sec/cm. This is about 50% faster than a prior similar test conducted under 1 atm. abs. pressure. For further comparison, this burn velocity of the ferrocyanide test is also about an order-of-magnitude slower than a slow burn gun powder at 1 atm. Pre- and post-test gas samples were taken and have been forwarded to WHC for further analyses. Details of these results are presented in Section 5.0 and comparisons with other similar reaction propagation rate tests are discussed in Section 6.0.

32509 (WHC-MR–0406) **Final report of the systems engineering technical advisory board for the Tank Waste Remediation Program.** Baranowski, F.P.; Goodlett, C.B.; Beard, S.J.; Duckworth, J.P.; Schneider, A.; Zahn, L.L. Westinghouse Hanford Co., Richland, WA (United States). Mar 1993. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018731. Source: OSTI; NTIS; INIS; GPO Dep.

The Tank Waste Remediation System (TWRS) is one segment of the environmental restoration program at the Hanford site. The scope is to retrieve the contents of both the single shell and double shell tanks and process the wastes into forms acceptable for long term storage and/or permanent disposal. The quantity of radioactive waste in tanks is significantly larger and substantially more complex in composition than the radioactive waste stored in tanks at other DOE sites. The waste is stored in 149 single shell tanks and 28 double shell tanks. The waste was produced over a period from the mid 1940s to the present. The single shell tanks have exceeded their design life and are experiencing failures. The oldest of the double shell tanks are approaching their design life. Spar double shell tank waste volume is limited. The priorities in the Board's view are to manage safely the waste tank farms, accelerate emptying of waste tanks, provide spare tank capacity and assure a high degree of confidence in performance of the TWRS integrated program. At its present design capacity, the glass vitrification plant (HWVP) will require a period of about 15 years to empty the double shell tanks; the addition of the waste in single shell tanks adds another 100 years. There is an urgent need to initiate now a well focused and centralized development and engineering program on both larger glass melters and advanced separations processes that reduce radioactive constituents in the low-level waste (LLW). The Board presents its conclusions and has other suggestions for the management plan. The Board reviews planning schedules for accelerating the TWRS program.

32510 (WHC-MR–0413) **Hanford Site Tank Waste Remediation System: Waste management 1993 symposium papers and viewgraphs.** Westinghouse Hanford Co., Richland, WA (United States). May 1993. 319p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930205–Pt.1: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 mar 1993). Order Number DE93018065. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy's (DOE) Hanford Site in southeastern Washington State has the most diverse and largest amount of highly radioactive waste of any site in the US. High-level radioactive waste has been stored in large underground tanks since 1944. A Tank Waste Remediation System Program has been established within the DOE to safely manage and immobilize these wastes in anticipation of permanent disposal in a geologic repository. The Hanford Site Tank Waste Remediation System Waste Management 1993 Symposium Papers and Viewgraphs covered the following topics: Hanford Site Tank Waste Remediation System Overview; Tank Waste Retrieval Issues and Options for their Resolution; Tank Waste Pretreatment - Issues, Alternatives and Strategies for Resolution; Low-Level Waste Disposal - Grout Issue and Alternative Waste Form Technology; A Strategy for Resolving High-Priority Hanford Site Radioactive Waste Storage Tank Safety Issues; Tank Waste Chemistry - A New Understanding of Waste Aging; Recent Results from Characterization of Ferrocyanide Wastes at the Hanford Site; Resolving the Safety Issue for Radioactive Waste Tanks with High Organic Content; Technology to Support Hanford Site Tank Waste Remediation System Objectives.

32511 (WHC-MR–0416) **Miscellaneous information regarding operation and inventory of 618-11 Burial Ground.** Webb, C.R. Westinghouse Hanford Co., Richland, WA (United States). Jun 1993. 94p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93017799. Source: OSTI; NTIS; GPO Dep.

Engineering drawings for this project are identified as CAPE-3065. Inquires may be directed to: Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831 (United States).

This report is a compilation of inventories and radiation surveys taken for the 618-11 Burial Ground at Hanford. This report deals with waste management activities at the facility during the early to mid-1960s.

32512 (WHC-SA–1753) **Developing waste disposal options in the underground storage tank - integrated demonstration program.** Cruse, J.M.; Gilchrist, R.L. Westinghouse Hanford Co., Richland, WA (United States). Jun 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930913–18: Global '93: future nuclear systems - emerging fuel cycles and waste disposal options, Seattle, WA (United States), 12-17 Sep 1993). Order Number DE93019124. Source: OSTI; NTIS; INIS; GPO Dep.

The principal objective of the Underground Storage Tank - Integrated Demonstration (UST-ID Program is the demonstration and continued development of technologies suitable for the remediation of USTs. The most promising new technologies from industry, universities, national laboratories, and other government agencies are selected for demonstration, testing, and evaluation. The objective is the eventual transfer of new technologies as part of a system to full-scale remediation at US Department of Energy (DOE) sites and alternately into the private sector. Technologies under development in the UST-ID Program are targeted toward use in remediation actions at the following five DOE participant sites: Hanford, Fernald, Idaho, Oak Ridge, and Savannah River. Combined, these participant sites have more than 300 USTs containing more than 381,800 m^3 (100 Mgal) of high-level and low-level radioactive liquid waste. This paper focuses on the Low-Level Waste Disposal area of the UST-ID, summarizing the two currently funded technology development projects: the Nitrate to Ammonia and Ceramic (NAC)

Process and Polyethylene Encapsulation. Both technologies are considered options to the-current baseline disposal approaches being developed at the participant sites. For the Hanford Site, this baseline is a grout waste form that is nearing implementation for disposal of low-level liquid tank wastes.

32513 (WHC-SA–1807) **Glass melter assembly for the Hanford Waste Vitrification Plant.** Chen, A.E. (Waste Chem Corp., Irvine, CA (US)); Russell, A.; Shah, K.R.; Kalia, J. Westinghouse Hanford Co., Richland, WA (United States). Jan 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930408–82: International high-level radioactive waste management conference, Las Vegas, NV (United States), 25-29 Apr 1993). Order Number DE93018734. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Waste Vitrification Plant (HWVP) is designed to solidify high level radioactive waste by converting it into stable borosilicate after mixing with glass frit and water. The heart of this conversion process takes place in the glass melter. The life span of the existing melter is limited by the possible premature failure of the heater assembly, which is not remotely replaceable, in the riser and pour spout. A goal of HWVP Project is to design remotely replaceable riser and pour spout heaters so that the useful life of the melter can be prolonged. The riser pour spout area is accessible only by the canyon crane and impact wrench. It is also congested with supporting frame members, service piping, electrode terminals, canister positioning arm and other various melter components. The visibility is low and the accessibility is limited. The problem is further compounded by the extreme high temperature in the riser core and the electrical conductive nature of the molten glass that flows through it.

32514 (WHC-SD-EN-AP–139) **Description of work for 100-DR-2 Operable Unit Vadose Drilling/test pits.** Naiknimbalkar, N. Westinghouse Hanford Co., Richland, WA (United States). [1993]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93019266. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the scope of work for the boreholes/test pits of the 100-DR-2 Operable Unit. Sampling and field activities include: Soil screening; geologic sampling; soil sampling (physical property); analytical sampling and depths; and geophysical logging.

32515 (WHC-SD-EN-AP–142) **Description of work for 216-U-Pond cone penetrometer demonstration.** Kelty, G.G. Westinghouse Hanford Co., Richland, WA (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93019353. Source: OSTI; NTIS; INIS; GPO Dep.

This description of work details the Proposed field activities associated with Cone Penetrometer (CPT) work at the 216-U-10 Pond (U-10 Pond) in the 200 West Area and will serve as a field guide for those performing the work. The U-10 Pond was constructed in 1944 to receive low-level liquid effluent from the various chemical reprocessing facilities within the 200 West Area. The U-10 Pond covered 30 acres and received approximately 4.3×10^{10} gal of contaminated liquid. Sampling conducted in 1980 indicated that the most significant radionuclides were ^{90}Sr, ^{137}Cs, plutonium, and uranium (DOE-RL 1993). The pond was deactivated and stabilized in 1985 with clean fill dirt. The thickness of the stabilization cover is variable across the former pond and ranges between 2 ft near the pond margins and delta area to 8 feet in the deepest section of the pond. The purpose of this work is to establish the extent of contamination beneath the U-10 pond.

32516 (WHC-SD-EN-TI–174) **Geophysical investigation of 218-W-4C trenches #1 and #4, 200 west.** Kiesler, J.P.; Bergstrom, K.A.; Mitchell, T.H. Westinghouse Hanford Co., Richland, WA (United States). 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93040394. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of these surveys was to determine the effectiveness of Ground-Penetrating Radar (GPR) for defining the depth and location of barrels in Burial Ground 218-W-4C, 200 West area of the Hanford Reservation. GPR data were collected in a portion of trench #1-module 3 and trench #4. The GPR system used for this work utilized a 300-megahertz antenna to transmit the electromagnetic energy into the ground. A percentage of the transmitted energy is reflected back to a receiving antenna where variations in the return signal are recorded. Common reflectors include natural geologic conditions such as bedding, cementation moisture and clay, or man-made objects such as pipes, barrels, foundations and buried wires. Depth of penetration, which varies with changes in geology, ranged from 10 to 15 feet for this survey. The method is limited in depth by transmit power, receiver sensitivity and attenuation of the transmitted energy. Depth of investigation is also limited by highly conductive materials, such as metal drums, which reflect all the transmitted energy, preventing investigation below such objects. Display and interpretation of the data are similar to that of seismic reflection data. In some areas interpretations can be straight forward, however, unknown parameters within a highly variable subsurface often yield complex data.

32517 (WINCO–11918) **ICPP waste management technology development program.** Hogg, G.W. (Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States)); Olson, A.L.; Knecht, D.A.; Bonkoski, M.J. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). [1993]. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. (CONF-930205–74: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 mar 1993). Order Number DE93015662. Source: OSTI; NTIS; INIS; GPO Dep.

A program has been implemented at the Idaho Chemical Processing Plant (ICPP) to identify technologies for disposing of sodium-bearing liquid radioactive waste, radioactive calcine, and irradiated spent fuel stored at the Idaho National Engineering Laboratory (INEL). The sodium bearing waste and calcine, have resulted from ICPP reprocessing operations conducted since 1953. The irradiated spent fuel consists of various fuel compositions and ranges from complete fuel elements to fuel pieces for which no reprocessing flowsheet had been identified. The program includes a very strong systems analysis program to assure complete consideration of all issues (technical, economic, safety, environmental, etc.) affecting final disposal of the waste and spent fuel. A major goal of the program is to assure the final implementation is environmentally acceptable, ensures public and worker safety, and is economically feasible.

32518 (WINCO–11926) **Technology development program for Idaho Chemical Processing Plant spent fuel and waste management.** Ermold, L.F.; Knecht, D.A.; Hogg, G.W.; Olson, A.L. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). [1993]. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. (CONF-930906–11: '93 international conference on nuclear waste management and environmental remediation, Prague (Czech Republic), 5-11 Sep 1993). Order Number DE93015567. Source: OSTI; NTIS; INIS; GPO Dep.

Irradiated nuclear fuel has been reprocessed at the Idaho Chemical Processing Plant (ICPP) since 1953 to recover uranium-235 and krypton-85 for the US Department of Energy (DOE). The resulting acidic high-level liquid radioactive waste (HLLW) has been solidified to a high-level waste (HLW) calcine since 1963 and stored in stainless-steel bins enclosed in concrete vaults. Residual HLW and radioactive sodium-bearing waste are stored in stainless-steel underground tanks contained in concrete vaults. Several different types of unprocessed irradiated DOE-owned fuels are also stored at INEL. In April, 1992, DOE announced that spent fuel would no longer be reprocessed to recover enriched uranium. As a result of the decision to curtail reprocessing the ICPP Spent Fuel and Waste Management Technology Development plan has been implemented to identify acceptable options for disposing of the (1) sodium-bearing liquid radioactive waste, (2) radioactive calcine, and (3) irradiated spent fuel stored at the INEL. The plan was developed jointly by DOE and Westinghouse Idaho Nuclear Company, Inc., (WINCO) and with the concurrence of the State of Idaho.

32519 (WSRC-MS–92-267) **Steam stripping of polycyclic aromatics from simulated high-level radioactive waste.** Lambert, D.P.; Shah, H.B.; Young, S.R.; Edwards, R.E.; Carter, J.T. Westinghouse Savannah River Co., Aiken, SC (United States). 1992. 37p. Sponsored by USDOE, Washington, DC (United

States). DOE Contract AC09-89SR18035. (CONF-9308133–2: Army symposium on solid mechanics, Plymouth, MA (United States), 17-19 Aug 1993). Order Number DE93017279. Source: OSTI; NTIS; INIS; GPO Dep.

The Defense Waste Processing Facility (DWPF) at the Savannah River Site (SRS) will be the United States' first facility to process High Level radioactive Waste (HLW) into a borosilicate glass matrix. The removal of aromatic precipitates by hydrolysis, evaporation, liquid-liquid extraction and decantation will be a key step in the processing of the HLW. This step, titled the Precipitate Hydrolysis Process, has been demonstrated by the Savannah River Technology Center with the Precipitate Hydrolysis Experimental Facility (PHEF). The mission of the PHEF is to demonstrate processing of simulated high level radioactive waste which contains tetraphenylborate precipitates and nitrite. Aqueous washing or nitrite destruction is used to reduce nitrite. Formic acid with a copper catalyst is used to hydrolyze tetraphenylborate (TPB). The primary offgases are benzene, carbon dioxide, nitrous oxide, and nitric oxide. Hydrolysis of TPB in the presence of nitrite results in the production of polycyclic aromatics and aromatic amines (referred as high boiling organics) such as biphenyl, diphenylamine, terphenyls etc. The decanter separates the organic (benzene) and aqueous phase, but the high boiling organic separation is difficult. This paper focuses on the evaluation of the operating strategies, including steam stripping, to maximize the removal of the high boiling organics from the aqueous stream. Two areas were investigated, (1) a stream stripping comparison of the late wash flowsheet to the HAN flowsheet and (2) the extraction performance of the original decanter to the new decanter. The focus of both studies was to minimize the high boiling organic content of the Precipitate Hydrolysis Aqueous (PHA) product in order to minimize downstream impacts caused by organic deposition.

32520 (WSRC-MS–93-263) **Foam technology as a decontamination/waste minimization tool.** Guthrie, W.S. Westinghouse Savannah River Co., Aiken, SC (United States). 1993. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-931095–2: Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993). Order Number DE93017290. Source: OSTI; NTIS; GPO Dep.

Foam decontamination technology is being developed at the Savannah River Site (SRS) as a waste minimization tool. Experience with foam decontamination technology has shown a significant waste reduction of up to 70% over current decontamination methods. Foam allows decontamination of a wide variety of surface geometries with a minimum of waste. Current decontamination practice at SRS for the removal of surface contamination on metal walls and complex parts is to spray repeated applications of decon solutions on the wall or part. As the solution runs off any vertical surface, contact time is minimal, requiring a large volume of the solution to complete the task. The process is labor intensive and often takes place in an area where a radiation field exits. In addition, there is the potential for exposure to contamination and exposure to the decon solution. Decon solutions with a foaming agent can be applied in a thin layer to a surface in any orientation, even to overhead surfaces. The decon solution is held within the foam, increasing dwell time, productivity, safety, and reducing personnel exposure.

32521 (WSRC-RP–89-675) **Estimates for Pu-239 loadings in burial ground culverts based on fast/slow neutron measurements.** Winn, W.G.; Hochel, R.C.; Hofstetter, K.J.; Sigg, R.A. Westinghouse Savannah River Co., Aiken, SC (United States). 15 Aug 1989. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93018773. Source: OSTI; NTIS; INIS; GPO Dep.

This report provides guideline estimates for Pu-239 mass loadings in selected burial ground culverts. The relatively high recorded Pu-239 contents of these culverts have been appraised as suspect relative to criticality concerns, because they were assayed only with the solid waste monitor (SWM) per gamma-ray counting. After 1985, subsequent waste was also assayed with the neutron coincidence counter (NCC), and a comparison of the assay methods showed that the NCC generally yielded higher assays than the SWM. These higher NCC readings signaled a need to conduct non-destructive/non-intrusive nuclear interrogations of these culverts, and a technical team conducted scoping measurements to illustrate potential assay methods based on neutron and/or gamma counting. A fast/slow neutron method has been developed to estimate the Pu-239 in the culverts. In addition, loading records include the SWM assays of all Pu-239 cuts of some of the culvert drums and these data are useful in estimating the corresponding NCC drum assays from NCC vs SWM data. Together, these methods yield predictions based on direct measurements and statistical inference.

32522 (WSRC-RP–93-692-Rev.1) **Assessment of nuclear safety and nuclear criticality potential in the Defense Waste Processing Facility: Revision 1.** Ha, B.C. Westinghouse Savannah River Co., Aiken, SC (United States). 20 Jul 1993. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93019275. Source: OSTI; NTIS; INIS; GPO Dep.

The S-Area Defense Waste Processing Facility (DWPF) will initially process Batch 1 sludge in the sludge-only processing mode, with simulated non-radioactive Precipitate Hydrolysis, Aqueous (PHA) product, without the risk of nuclear criticality. The dilute concentration of fissile material in the sludge combined with excess of neutron absorbers during normal operations make criticality throughout the whole process incredible. Subsequent batches of the DWPF involving radioactive precipitate slurry and PHA will require additional analysis. Any abnormal or upset process operations, which are not considered in this report and could potentially separate fissile material, must be individually evaluated. Scheduled maintenance operation procedures are not considered to be abnormal.

32523 (WSRC-TR–92-308-Rev.1) **Chemical compatibility of DWPF canistered waste forms: Revision 1.** Harbour, J.R. Westinghouse Savannah River Co., Aiken, SC (United States). 25 Jun 1993. 52p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93018200. Source: OSTI; NTIS; INIS; GPO Dep.

The Waste Acceptance Preliminary Specifications (WAPS) require that the contents of the canistered waste form are compatible with one another and the stainless steel canister. The canistered waste form is a closed system comprised of a stainless steel vessel containing waste glass, air, and condensate. This system will experience a radiation field and an elevated temperature due to radionuclide decay. This report discusses possible chemical reactions, radiation interactions, and corrosive reactions within this system both under normal storage conditions and after exposure to temperatures up to the normal glass transition temperature, which for DWPF waste glass will be between 440 and 460°C. Specific conclusions regarding reactions and corrosion are provided. This document is based on the assumption that the period of interim storage prior to packaging at the federal repository may be as long as 50 years.

32524 (WSRC-TR–92-346-Rev.1) **Characterization of the Defense Waste Processing Facility (DWPF) Environmental Assessment (EA) glass Standard Reference Material: Revision 1.** Jantzen, C.M.; Bibler, N.E.; Beam, D.C.; Crawford, C.L.; Pickett, M.A. Westinghouse Savannah River Co., Aiken, SC (United States). 1 Jun 1993. 93p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93016127. Source: OSTI; NTIS; INIS; GPO Dep.

Liquid high-level nuclear waste at the Savannah River Site (SRS) will be immobilized by vitrification in borosilicate glass. The glass will be produced and poured into stainless steel canisters in the Defense Waste Processing Facility (DWPF). Other waste form producers, such as West Valley Nuclear Services (WVNS) and the Hanford Waste Vitrification Project (HWVP), will also immobilize high-level radioactive waste in borosilicate glass. The canistered waste will be stored temporarily at each facility for eventual permanent disposal in a geologic repository. The Department of Energy has defined a set of requirements for the canistered waste forms, the Waste Acceptance Product Specifications (WAPS). The current Waste Acceptance Primary Specification (WAPS) 1.3, the product consistency specification, requires the waste form producers to

demonstrate control of the consistency of the final waste form using a crushed glass durability test, the Product Consistency Test (PCI). In order to be acceptable, a waste glass must be more durable during PCT analysis than the waste glass identified in the DWPF Environmental Assessment (EA). In order to supply all the waste form producers with the same standard benchmark glass, 1000 pounds of the EA glass was fabricated. The chemical analyses and characterization of the benchmark EA glass are reported. This material is now available to act as a durability and/or redox Standard Reference Material (SRM) for all waste form producers.

32525 (WSRC-TR–92-478) **Benzene Monitor System report.** Livingston, R.R. Westinghouse Savannah River Co., Aiken, SC (United States). 12 Oct 1992. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93019271. Source: OSTI; NTIS; INIS; GPO Dep.

Two systems for monitoring benzene in aqueous streams have been designed and assembled by the Savannah River Technology Center, Analytical Development Section (ADS). These systems were used at TNX to support sampling studies of the full-scale "SRAT/SME/PR" and to provide real-time measurements of benzene in Precipitate Hydrolysis Aqueous (PHA) simulant. This report describes the two ADS Benzene Monitor System (BMS) configurations, provides data on system operation, and reviews the results of scoping tests conducted at TNX. These scoping tests will allow comparison with other benzene measurement options being considered for use in the Defense Waste Processing Facility (DWPF) laboratory. A report detailing the preferred BMS configuration statistical performance during recent tests has been issued under separate title: Statistical Analyses of the At-line Benzene Monitor Study, SCS-ASG-92-066. The current BMS design, called the At-line Benzene Monitor (ALBM), allows remote measurement of benzene in PHA solutions. The authors have demonstrated the ability to calibrate and operate this system using peanut vials from a standard Hydragard™ sampler. The equipment and materials used to construct the ALBM are similar to those already used in other applications by the DWPF lab. The precision of this system (±0.5% Relative Standard Deviation (RSD) at 1 sigma) is better than the purge & trap-gas chromatograpy reference method currently in use. Both BMSs provide a direct measurement of the benzene that can be purged from a solution with no sample pretreatment. Each analysis requires about five minutes per sample, and the system operation requires no special skills or training. The analyzer's computer software can be tailored to provide desired outputs. Use of this system produces no waste stream other than the samples themselves (i.e. no organic extractants).

32526 (WSRC-TR–93-251) **Hazardous Waste/Mixed Waste Treatment Building Safety Information Document (SID).** Fatell, L.B.; Woolsey, G.B. Westinghouse Savannah River Co., Aiken, SC (United States). 15 Apr 1993. 129p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93018775. Source: OSTI; NTIS; INIS; GPO Dep.

This Safety Information Document (SID) provides a description and analysis of operations for the Hazardous Waste/Mixed Waste Disposal Facility Treatment Building (the Treatment Building). The Treatment Building has been classified as a moderate hazard facility, and the level of analysis performed and the methodology used are based on that classification. Preliminary design of the Treatment Building has identified the need for two separate buildings for waste treatment processes. The term Treatment Building applies to all these facilities. The evaluation of safety for the Treatment Building is accomplished in part by the identification of hazards associated with the facility and the analysis of the facility's response to postulated events involving those hazards. The events are analyzed in terms of the facility features that minimize the causes of such events, the quantitative determination of the consequences, and the ability of the facility to cope with each event should it occur. The SID presents the methodology, assumptions, and results of the systematic evaluation of hazards associated with operation of the Treatment Building. The SID also addresses the spectrum of postulated credible events, involving those hazards, that could occur. Facility features important to safety are identified and discussed in the SID. The SID identifies hazards and reports the analysis of the spectrum of credible postulated events that can result in the following consequences: Personnel exposure to radiation; Radioactive material release to the environment; Personnel exposure to hazardous chemicals; Hazardous chemical release to the environment; Events leading to an onsite/offsite fatality; and Significant damage to government property. The SID addresses the consequences to the onsite and offsite populations resulting from postulated credible events and the safety features in place to control and mitigate the consequences.

32527 (WSRC-TR–93-293) **Mechanical degradation temperature of waste storage materials.** Fink, M.C.; Meyer, M.L. Westinghouse Savannah River Co., Aiken, SC (United States). 13 May 1993. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93019837. Source: OSTI; NTIS; INIS; GPO Dep.

Heat loading analysis of the Solid Waste Disposal Facility (SWDF) waste storage configurations show the containers may exceed 90°C without any radioactive decay heat contribution. Contamination containment is primarily controlled in TRU waste packaging by using multiple bag layers of polyvinyl chloride and polyethylene. Since literature values indicate that these thermoplastic materials can begin mechanical degradation at 66°C, there was concern that the containment layers could be breached by heating. To better define the mechanical degradation temperature limits for the materials, a series of heating tests were conducted over a fifteen and thirty minute time interval. Samples of a low-density polyethylene (LDPE) bag, a high-density polyethylene (HDPE) high efficiency particulate air filter (HEPA) container, PVC bag and sealing tape were heated in a convection oven to temperatures ranging from 90 to 185°C. The following temperature limits are recommended for each of the tested materials: (1) low-density polyethylene – 110°C; (2) polyvinyl chloride – 130°C; (3) high-density polyethylene – 140°C; (4) sealing tape – 140°C. Testing with LDPE and PVC at temperatures ranging from 110 to 130°C for 60 and 120 minutes also showed no observable differences between the samples exposed at 15 and 30 minute intervals. Although these observed temperature limits differ from the literature values, the trend of HDPE having a higher temperature than LDPE is consistent with the reference literature. Experimental observations indicate that the HDPE softens at elevated temperatures, but will retain its shape upon cooling. In SWDF storage practices, this might indicate some distortion of the waste container, but catastrophic failure of the liner due to elevated temperatures (<185°C) is not anticipated.

32528 (WSRC-TR–93-314) **Hazards Assessment Document of the New Waste Transfer Facility (NWTF).** Pareizs, J.M. Westinghouse Savannah River Co., Aiken, SC (United States). Jun 1993. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93019279. Source: OSTI; NTIS; INIS; GPO Dep.

This Hazards Assessment Document for the New Waste Transfer Facility (NWTF) has been prepared in accordance with the Interim Hazards Classification Guide for Non-Reactor Facilities at Savannah River Site. The conclusion of this assessment is that the facility is a High Hazard Nuclear Facility. The NWTF consists of all facilities installed by Project S-3122. The NWTF contains three segments. Segment 1 consists of the cells containing the diversion box and pump pits, with a Facility Segment Use Category (FSUC) determined to be High Hazard. Segment 2 is the building that encloses the cells. The FSUC of Segment 2 has been determined to be Low Hazard. Segment 3 consists of all parts of the facility external to the main building; this segment contains the ventilation system and HEPA filters and includes the diesel fuel tank. The FSUC of Segment 3 is Low Hazard.

0530 Environmental Aspects

Refer also to citation(s) 32360, 32361, 32392, 32396, 32402, 32415, 32438, 32440, 32442, 32538, 32551, 32554, 32555, 32562, 32575, 32820, 32821, 33002, 33287, 33748, 33804

32529 (DOE/EA–0822(2)) **Idaho National Engineering Laboratory Consolidated Transportation Facility: Environmental Assessment.** USDOE Idaho Operations Office, Idaho Falls, ID

(United States). Apr 1993. 32p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93017301. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy (DOE) has prepared an environmental assessment (EA), DOE/EA-0822, addressing environmental impacts that could result from siting, construction, and operation of a consolidated transportation facility at the Idaho National Engineering Laboratory (INEL) near Idaho Falls, Idaho. The DOE proposes to construct and operate a new transportation facility at the Central Facilities Area (CFA) at the INEL. The proposed facility would replace outdated facilities and consolidate in one location operations that are conducted at six different locations at the CFA. The proposed facility would be used for vehicle and equipment maintenance and repair, administrative support, bus parking, and bus driver accommodation. Based on the analyses in the EA, DOE has determined that the proposed action is not a major Federal action significantly affecting the quality of the human environment, within the meaning of the National Environmental Policy Act (NEPA) of 1969, as amended. Therefore, the preparation of an environmental impact statement (EIS) is not required and the Department is issuing this finding of no significant impact.

32530 (DOE/OR/21949–367) **Niagara Falls Storage Site environmental report for calendar year 1992, 1397 Pletcher Road, Lewiston, New York: Formerly Utilized Sites Remedial Action Program (FUSRAP).** Bechtel National, Inc., Oak Ridge, TN (United States). May 1993. 150p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-91OR21949. Order Number DE93018599. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the environmental surveillance program at the Niagara Falls Storage Site (NFSS) and provides the results for 1992. From 1944 to the present, the primary use of NFSS has been storage of radioactive residues produced as a by-product of uranium production. All onsite areas of residual radioactivity above guidelines have been remediated. Materials generated during remediation are stored onsite in the 4-ha (10-acre) waste containment structure (WCS). The WCS is a clay-lined, clay-capped, and grass-covered storage pile. The environmental surveillance program at NFSS includes sampling networks for radon concentrations in air; external gamma radiation exposure; and total uranium and radium-226 concentrations in surface water, sediments, and groundwater. Several chemical parameters, including seven metals, are also routinely measured in groundwater. This surveillance program assists in fulfilling the DOE policy of measuring and monitoring effluents from DOE activities and calculating hypothetical doses. Monitoring results are compared with applicable Environmental Protection Agency (EPA) and New York State Department of Environmental Conservation (NYSDEC) standards, DOE derived concentration guides (DCGs), dose limits, and other DOE requirements. Results of environmental monitoring during 1992 indicate that levels of the parameters measured were in compliance with all but one requirement: Concentrations of iron and manganese in groundwater were above NYSDEC groundwater quality standards. However, these elements occur naturally in the soils and groundwater associated with this region. In 1992 there were no environmental occurrences or reportable quantity releases.

32531 (DOE/RL–93-36) **Radionuclide air emissions report for the Hanford Site, calendar year 1992.** Diediker, L.P. (Westinghouse Hanford Co., Richland, WA (United States)); Johnson, A.R.; Rhoads, K.; Klages, D.L.; Soldat, J.K.; Rokkan, D.J. Westinghouse Hanford Co., Richland, WA (United States). Jun 1993. 112p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018737. Source: OSTI; NTIS; INIS; GPO Dep.

This report documents radionuclide air emissions from the Hanford Site in 1992 and the resulting effective dose equivalent to an member of the public. The report has been prepared and will be submitted in accordance with reporting requirements in the Code of Federal Regulations, Title 40, Protection of the Environment, Part 61, "National Emissions Standards for Hazardous Air Pollutants," Subpart H, "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities."

32532 (DOE/RL–93-56-1) **Quarterly report of RCRA groundwater monitoring data for period January 1, 1993 through March 31, 1993.** USDOE Richland Field Office, WA (United States). Jul 1993. 425p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93019319. Source: OSTI; NTIS; GPO Dep.

Hanford Site interim-status groundwater monitoring projects are conducted as either background, indicator parameter evaluation, or groundwater quality assessment monitoring programs as defined in the Resource Conservation and Recovery Act of 1976 (RCRA); and Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, as amended (40 Code of Federal Regulations [CFR] 265). Compliance with the 40 CFR 265 regulations is required by the Washington Administrative Code (WAC) 173-303. This report contains data from Hanford Site groundwater monitoring projects. This quarterly report contains data received between March 8 and May 24, 1993, which are the cutoff dates for this reporting period. This report may contain not only data from the January through March quarter but also data from earlier sampling events that were not previously reported.

32533 (INIS-mf–13676) **Mining and the environment.** Janecka, V.; Nemec, V.; Bradka, S.; Placek, V.; Sulovsky, P. Ceskoslovensky Uranovy Prumsl, Pribam (Czech Republic). 1992. 168p. (In Czech). (CONF-9210351–: The mining town of Pribram in science and technology, Pribram (Czechoslovakia), 12-14 Oct 1992). Order Number DE93633757. Source: OSTI; NTIS (US Sales Only); INIS.

The proceedings contain 30 contributions, out of which 9 have been abstracted and indexed for the database. These concerned uranium mines and mills in the Czech Republic. Assessments of the impacts of the mining activities and of the mill tailings on the environment and the population are described, and it is concluded that the radiation hazard does not exceed that from natural background. Considerable attention is paid to the monitoring of the surroundings of mines and mills and to landscaping activities. Proposed technologies for the purification of waste waters from the chemical leaching process are described. Ways to eliminate environmental damage from abandoned tailings settling ponds are suggested. (M.D.). 18 tabs., 21 figs., 43 refs.

32534 (NUREG/CP–0040, pp. 8-13) **Hydrogeologic issues at Yucca Mountain: Findings of a DOE peer review team.** Freeze, R.A. (Univ. of British Columbia (CA)). Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

The peer review team (PRT) evaluated work done within the Yucca Mountain Project to develop an understanding of unsaturated zone hydrology at the Yucca Mountain sites, and to provide recommendations to DOE regarding unsaturated zone hydrological investigations at Yucca Mountain. The PRT was specifically asked to consider: matrix flow; fracture flow; gaseous flow; the presence and effectiveness of capillary barriers; the presence and effectiveness of fracture barriers; and saturated-unsaturated ground water travel times. The PRT deliberations emphasize the natural hydrogeological system rather than the response of this system to the emplacement of the repository. Twenty-four conclusions and recommendations were reached. Among the programmatic issues were: need for improved program integration and interagency communication; need for project prioritization procedures within the project; negative impacts of the current quality assurance environment; need for closer coordination of construction activities and research activities so as to prevent undue site disturbance. This paper discusses the additional technical issues raised in the report, including both the unsaturated zone and the saturated zone, with a primary emphasis on the unsaturated zone. 8 refs.

32535 (WINCO–11902) **Decontamination of the ICPP main stack.** Waite, T. Westinghouse Idaho Nuclear Co., Inc., Idaho

Falls, ID (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. (CONF-930601–22: American Nuclear Society (ANS) annual meeting, San Diego, CA (United States), 20-24 Jun 1993). Order Number DE93014881. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes efforts to remove deposits in a stack liner which resulted from a release of Ammonium Nitrate particles with low levels of contamination.

32536 (WINCO–11913) **INEL historical dose evaluation: Reconstruction of operational airborne releases of radioactivity to the environment.** Wenzel, D.R. (Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States)); Peterson, H.K.; Dickson, R.L. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. (CONF-930130–17: 26. Health Physics Society midyear topical meeting on environmental health physics, Coeur d'Alene, ID (United States), 24-28 Jan 1993). Order Number DE93015574. Source: OSTI; NTIS; INIS; GPO Dep.

Airborne releases of radioactivity from the operation of reactors and processes at the Idaho National Engineering Laboratory (INEL) since the early 1950s have been reconstructed. Operational releases discussed are those which are continuous and somewhat uniform over a period of time. The primary source of information on operational releases was the measurement of stack effluents as reported in the Radioactive Waste Management Information System (RWMIS) data base and technical reports. The data in the RWMIS data base is generally complete and reliable for releases that occurred since the early 1970s. Data for the 1960s was found to be less detailed and reflected less sophisticated monitoring instrumentation and record keeping systems. Data for the 1950s in general did not identify the specific mixture of radionuclides released. Operational releases of airborne radioactivity from the INEL, particularly in the early years of operation, have been reconstructed using current computer programs with reactor operating and fuel processing knowledge. Techniques used to reconstruct releases of airborne radioactivity to the environment from INEL operational releases and problems encountered are discussed.

32537 (WSRC-TR–93-274) **K-Area and Par Pond Sewage Sludge Application Sites Groundwater Monitoring Report: First quarter 1993.** Westinghouse Savannah River Co., Aiken, SC (United States). Jul 1993. 68p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93019838. Source: OSTI; NTIS; GPO Dep.

Samples from the three wells at the K-Area Sewage Sludge Application Site (KSS wells) and the three wells at the Par Pond Sewage Sludge Application Site (PSS wells) are analyzed quarterly for constituents required by South Carolina Department of Health and Environmental Control Construction Permit 13,173 and, as requested, for other constituents as part of the Savannah River Site Groundwater Monitoring Program. Annual analyses for other constituents, primarily metals, also are required by the permit. During first quarter 1993, no permit-required constituents exceeded standards at the two sites except iron, which was elevated in one KSS well and two PSS wells. Aluminum, not required by the permit, was the only other constituent that exceeded standards. Elevated levels of aluminum and iron at these two sites may be concurrent with a change in analytical methodology. As in previous quarters, chlordane concentrations did not exceed the detection limit in any of the wells.

0540 Health and Safety

Refer also to citation(s) 32338, 32343, 32344, 32361, 32362, 32371, 32374, 32382, 32383, 32384, 32397, 32399, 32403, 32405, 32410, 32416, 32485, 32502, 32514, 32515, 32516, 32520, 32522, 32526, 32528, 32531, 32533, 32535, 32591, 32906, 32918, 32920, 32954, 33061, 33209, 33386, 33700, 33793, 33802, 33824, 33915, 33960

32538 (ANL–92/14) **Argonne National Laboratory-East site environmental report for calendar year 1991.** Golchert, N.W.; Duffy, T.L.; Moos, L.P. Argonne National Lab., IL (United States). May 1992. 236p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93016725. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the results of the environmental protection program at Argonne National Laboratory-East (ANL) for 1991. To evaluate the effects of ANL operations on the environment, samples of environmental media collected on the site, at the site boundary, and off the ANL site were analyzed and compared to applicable guidelines and standards. A variety of radionuclides was measured in air, surface water, groundwater, soil, grass, and bottom sediment samples. Chemical constituents in surface water, groundwater, and ANL effluent water were analyzed. External penetrating radiation doses were measured and the potential for radiation exposure to off-site population groups was estimated. Results are interpreted in terms of the origin of the radioactive and chemical substances (natural, fallout, ANL, and other) and are compared with applicable environmental quality standards. A US Department of Energy (DOE) dose calculation methodology, based on International Commission on Radiological Protection (ICRP) recommendations and the CAP-88 version of the EPA-AIRDOSE/RADRISK computer code, is used in this report. The status of ANL environmental protection activities with respect to the various laws and regulations which govern waste handling and disposal is discussed. This report also discusses progress being made on environmental corrective actions and restoration projects from past activities.

32539 (CONF-931019–1) **A survey of ecological risk assessment at DOE facilities.** Barnthouse, L.W. (Oak Ridge National Lab., TN (United States)); Bascietto, J.; Joseph, T.; Bilyard, G. Oak Ridge National Lab., TN (United States). [1992]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Annual model conference; Oak Ridge, TN (United States); 19-22 Oct 1993. Order Number DE93000972. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) Risk-Based Standards Working Group is studying standard-setting and remedial action based on realistic estimates of human health and ecological risks. Federal and state regulations require DOE to assess ecological risks due to present and past operation of DOE facilities and ecological damage caused by remedial actions. Unfortunately, little technical guidance has been provided by regulatory agencies about how these assessments should be performed or what constitutes an adequate assessment. Active ecological research, environmental characterization, and ecological risk assessment programs are already underway at many locations. Some of these programs were established more than 30 years ago. Because of the strength of its existing programs and the depth of expertise available within the DOE complex, the agency is in a position to lead in developing ecological risk assessment procedures that are fully consistent with the general principles defined by EPA and that will ensure environmentally sound and cost-effective restoration of its sites. As a prelude to guidance development, the working group conducted a survey of ecological risk assessment activities at a subset of major DOE facilities. The survey was intended to (1) identify approaches now being used in ecological risk assessments performed by DOE staff and contractors at each site, (2) record successes and failures of these approaches, (3) identify new technical developments with potential for general application to many DOE facilities, and (4) identify major data needs, data resources, and methodological deficiencies.

32540 (DOE/DP–0018-Del.Ver.) **Operating experience feedback report: Analysis of occurrences caused by equipment and material problems: Deleted Version.** USDOE Assistant Secretary for Defense Programs, Washington, DC (United States). Safety Diagnostic Div. Jun 1993. 97p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93019187. Source: OSTI; NTIS; GPO Dep.

The Defense Program (DP) occurrence analysis reports identified problems with equipment and material directly to 30 to 40% of the occurrences in the DP facilities. These occurrences were analyzed to determine significance to safety-related systems and components. The analysis identified several safety systems and

components which should be included in cycles of inspection, preventive and corrective maintenance, and assessment to mitigate their failures. 91 to 98,Y. of the occurrences at Plutonium Fabrication (PUFAB), 371 operations, 771 Operations, Analytical Operations, F canyon, H canyon, K-Reactor and L-Reactor involved safety-related systems. The frequently failed systems are the Selective Alpha Air Monitor (SAAM), Emergency Diesel Generator (EDG), Ventilation, Radiation Alarm, Safety Computer, Fire Alarm, Radioactive Waste Transportation System, Glove Box, Power Distribution, Sprinkler, and Uninterruptable Power Supply (UPS).

32541 (DOE/EIS–0185F-387) **Responses to comments on the Remedial Investigation/Feasibility Study-Environmental Impact Statement for Remedial Action at the chemical plant area of the Weldon Spring Site, November 1992.** USDOE Oak Ridge Field Office, TN (United States); Argonne National Lab., IL (United States). Jun 1993. 182p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (DOE/OR/21548–387). Order Number DE93019015. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) is responsible for cleanup activities at the Weldon Spring site in St. Charles County, Missouri. The site consists of a chemical plant area and a noncontiguous limestone quarry; both areas are radioactively and chemically contaminated as a result of past processing and disposal activities. Explosives were produced by the US Army at the chemical plant in the 1940s, and uranium and thorium materials were processed by DOE's predecessor agency in the 1950s and 1960s. During that time, various wastes were disposed of at both areas of the site. The Weldon Spring site is on the National Priorities List (NPL) of the US Environmental Protection Agency (EPA). The DOE is conducting cleanup activities at the site under its Environmental Restoration and Waste Management Program. The RI/FS-EIS for remedial action at the chemical plant area of the Weldon Spring site was issued to the public on November 20, 1992. This public comment response document presents a summary of the major issues identified in both oral and written comments on the RI/FS-EIS and DOE's responses to those issues. This document also provides individual responses to the written comments.

32542 (DOE/FTR–93014688) **Travel to Europe to evaluate remote systems and robotics technology: Foreign trip report, May 1–19, 1992.** Griebenow, B.L. (Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States)); Gilchrist, R.L.; Yount, J.A.; Raymond, R.E. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States); Westinghouse Hanford Co., Richland, WA (United States). 26 Aug 1992. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435 ;AC06-87RL10930. Order Number DE93014688. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The capabilities and expertise of the Western European countries in the robotics and pretreatment areas have been evaluated on previous trips. Based upon these assessments and the needs of five Department of Energy (DOE) sites, a Light Duty Utility Arm (LDUA) was conceived to aid in remediating low level nuclear waste contained in underground storage tanks. Before a request for proposal could be let, it was necessary to determine the state of specific technology necessary to support the rigorous safety requirements that the arm would have to meet. To expedite the proposal process, it was determined that six firms located in North America and four European countries would be visited by USTID program and operations personnel. The primary purpose of these trips was to better understand the commercial capabilities, observe the hardware in operation, and conduct a technical exchange with the designers to uncover challenges in the fabrication and deployment of the LDUA. This report documents, in summary fashion, the findings of that effort; the North American visits are described in Appendix E. Detailed findings as to the strengths and weaknesses of each firm have not been described here because of sensitivities to an ongoing procurement process. However, a summary of the firm's area of expertise and the salient points of the technical discussions is included.

32543 (DOE/FTR–93014869) **Travel to France to develop analyses of combined data on nuclear workers in the US, UK, and Canada: Foreign trip report, February 29–March 21, 1992.** Gilbert, E.S. Pacific Northwest Lab., Richland, WA (United States). 24 Mar 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93014869. Source: OSTI; NTIS (US Sales Only); GPO Dep.

During the first week of my visit, Dr. Cardis (the IARC staff person responsible for the combined analyses), Dr. Carpenter (representing the UK studies), and I discussed several issues in detail, and made decisions regarding the manner these issues would be handled in the combined analyses. Later in my stay, these decisions were incorporated into a detailed plan indicating exactly how analyses would be conducted, and into a detailed outline for the final report. Ways of implementing the various desired analyses were determined, and included the use of EPICURE and adaptation of simulation routines used at PNL. Both Hanford and ORNL data were used to check files and analytic results being obtained at IARC. Several problems both with data sets and with the procedure used to prepare files for use in EPICURE were identified, and most were resolved. Because of these problems, and because of general difficulties in dealing with very large data sets, progress on actual analyses was limited. However, many problems were addressed and good progress was made toward resolving data discrepancies and implementing most desired analyses.

32544 (DOE/FTR–93015529) **Travel to Europe to evaluate electrokinetic technology applications to remedial treatment of metal contaminated soils and groundwater: Foreign trip report, December 11–18, 1991.** Tyler, L.D. Sandia National Labs., Albuquerque, NM (United States). 12 Mar 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93015529. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of this trip was to serve as a member of an evaluation team composed of the Department of Energy (DOE) and DOE contractor personnel to evaluate and assess the state of international electrokinetic technology as it is being applied to the remedial treatment of metal contaminated soils and groundwater. This travel was requested by DOE Office of Technology Development (OTD) to determine whether electrokinetic technology research, development, and field demonstrations on foreign soils and groundwater have applicability for the remediation of metal contamination at DOE sites.

32545 (DOE/FTR–93018108) **Invited guest of British to assist with establishment of British equivalent of the United States Transuranium and Uranium Registries: Foreign trip report, October 30–November 9, 1991.** Kathren, R.L. Hanford Environmental Health Foundation, Richland, WA (United States). 24 Jan 1992. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-65RL01837. Order Number DE93018108. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details the foreign travel and activities of Ronald L. Kathren, Director, United States Transuranium and uranium Registries (USTR/USUR), Hanford Environmental Health Foundation, Richland, WA, to meet with counterparts and visit various nuclear sites in Great Britain. The trip was organized and funded by the British and included orientation visits to and presentation of seminars at the British Nuclear Fuels, Limited, Sellafield site; Atomic Energy Establishment, Harwell; U.K. National Radiological Protection Board; and attendance and presentation of a seminar on the Registries at a meeting of the UNIKORNES management committee. The primary purpose of the trip was to assist the British with the establishment of UNIKORNES – a research program paralleling and complementing the US Transuranium and Uranium Registries, and to gain orientation into scientific and technical activities which have direct bearing on the activities of the USTR/USUR and the planned British equivalent. It is clear from the visit the British intend to proceed rapidly with the development of UNIKORNES, and that a similar program involving the European Community looms on the horizon. Perhaps most impressive was the orientation tour of the BNFL Sellafield site, where the British have the capability and are actively treating high level reactor wastes. Of even greater significance was the tour of the nearly completed fuel reprocessing plant at the Sellafield site which, when operational in mid-1992, will have the capability of reprocessing about 40 different types of commercial nuclear reactor fuels, including those used in US power

reactors. The British are very interested in providing reprocessing and high level radioactive waste treatment (solidification) to the US, and based upon their current and projected capabilities and potential costs and benefits, it is strongly recommended that the US carefully and seriously explore this potential option.

32546 (DOE/ID/12735–T27) **Projects at the Component Development and Integration Facility: Quarterly technical progress report, January 1–March 31, 1993.** MSE, Inc., Butte, MT (United States). [1993]. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-88ID12735. Order Number DE93041038. Source: OSTI; NTIS; GPO Dep.

This quarterly technical progress report presents progress on several different projects at the Component Development and Integration Facility (CDIF) during the second quarter of FY93. The CDIF is a major US Department of Energy test facility in Butte, Montana, operated by MSE, Inc. Projects in progress include: MHD Proof-of-Concept Project; Mine Waste Technology Pilot Program; Plasma Furnace Projects for waste destruction; Resource Recovery Project; Sodium Sulfide/Ferrous Sulfate Project; Soil Washing Project for removal of radioactive materials; and Spray Casting Project.

32547 (DOE/OR–01-1122-D3) **Interim remedial action work plan for the cesium plots at Waste Area Grouping 13 at Oak Ridge National Laboratory, Oak Ridge, Tennessee.** MK-Ferguson of Oak Ridge Co., TN (United States); Oak Ridge National Lab., TN (United States). Jul 1993. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/ER–157-D3). Order Number DE93017914. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Restoration Program.

This remedial action work plan (RAWP) is issued under the Federal Facility Agreement to provide a basic approach for implementing the interim remedial action (IRA) described in Interim Record of Decision for the Oak Ridge National Laboratory Waste Area Grouping 13 Cesium Plots, Oak Ridge, Tennessee. This RAWP summarizes the interim record of decision (IROD) requirements and establishes the strategy for the implementation of the field activities. As documented in the IROD document, the primary goal of this action is to reduce the risk to human health and the environment resulting from current elevated levels of gamma radiation on the site and at areas accessible to the public adjacent to the site. The major steps of this IRA are to: Excavate cesium-contaminated soil; place the excavated soils in containers and transport to Waste Area Grouping (WAG) 6; and backfill excavated plots with clean fill materials. The actual remedial action will be performed by Department of Energy prime contractor, MK-Ferguson of Oak Ridge Company. Remediation of the cesium plots will require approximately 60 days to complete. During this time, all activities will be performed according to this RAWP and the applicable specifications, plans, and procedures referred to in this document. The IRA on WAG 13 will prevent a known source of cesium-contaminated soil from producing elevated levels of gamma radiation in areas accessible to the public, eliminate sources of contamination to the environment, and reduce the risks associated with surveillance and maintenance of the WAG 13 site.

32548 (DOE/OR–01-1128-D1) **Postconstruction report of the United Nuclear Corporation Disposal Site at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee: Environmental Restoration Program.** Oakley, L.B.; Siberell, J.K.; Voskuil, T.L. Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States). Jun 1993. 236p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. (Y/ER–51-D1). Order Number DE93017234. Source: OSTI; NTIS; INIS; GPO Dep.

Engineering drawings for this project are identified as CAPE-3063. Inquiries may be directed to: Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831.

Remedial actions conducted under the auspices of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) were completed at the Y-12 United Nuclear Corporation (UNC) Disposal Site in August 1992. The purpose of this Postconstruction Report is to summarize numerous technical reports and provide CERCLA documentation for completion of the remedial actions. Other CERCLA reports, such as the Feasibility Study for the UNC Disposal Site, provide documentation leading up to the remedial action decision. The remedial action chosen, placement of a modified RCRA cap, was completed successfully, and performance standards were either met or exceeded. This remedial action provided solutions to two environmentally contaminated areas and achieved the goal of minimizing the potential for contamination of the shallow groundwater downgradient of the site, thereby providing protection of human health and the environment. Surveillance and maintenance of the cap will be accomplished to ensure cap integrity, and groundwater monitoring downgradient of the site will continue to confirm the acceptability of the remedial action chosen.

32549 (DOE/OR–01-1168-D1) **Risk characterization data manual for Category D inactive liquid low-level waste tank systems at Oak Ridge National Laboratory, Oak Ridge, Tennessee.** Oak Ridge National Lab., TN (United States). Jul 1993. 75p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/ER/Sub–90-LJ068/1-D1). Order Number DE93017755. Source: OSTI; NTIS; INIS; GPO Dep.

This manual reports the results of a risk characterization of Category D inactive liquid low-level radioactive waste (LLLW) underground storage tanks (USTs) at the Oak Ridge National Laboratory (ORNL). The risk characterization is required by the Federal Facility Agreement between the Department of Energy-Oak Ridge Operations Office, the Environmental Protection Agency-Region IV, and the Tennessee Department of Environment and Conservation. The intent of the risk characterization is to determine relative priorities for assessment and remediation. A total of 55 FFA Category D inactive LLLW tanks are discussed in this manual. Of the 39 tanks at ORNL that have been accepted into the Environmental Restoration (ER) Pregrain, all have been sampled for preliminary characterization, except for 5 tanks that were found to be empty plus 1 that was found not to exist. The remaining 16 tanks are in the Waste Management (WM) Program. Twelve were sampled for preliminary characterization, and four were found empty. Each sampled tank was scored on a scale of I to 5 on the basis of three criteria: (1) leak characteristics, (2) location, and (3) toxicological characteristics of residual sludges and liquids. Each criterion was assigned a weighing factor based on perceived importance. The criterion score multiplied by the weighting factor equaled the tank's total score for that criterion. The three weighted criterion scores for each tank were then summed for a total score for that tank. When the scores for all tanks had been weighted and summed, the tanks were ranked in descending order on the basis of their total scores. The highest possible score for a tank is 30. The descending rank order represents the recommended priorities for evaluation: the higher the score, the higher the priority for evaluation. Of the 54 tanks sampled in the risk characterization, 23 tanks scored 16 or higher, 11 scored between 10 and 15, 5 scored between 4 and 9, and 15 scored 3 or less.

32550 (DOE/OR–1060-D3) **Remedial investigation work plan for Bear Creek Valley Operable Unit 2 (Rust Spoil Area, SY-200 Yard, Spoil Area 1) at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee: Environmental Restoration Program.** Oak Ridge Y-12 Plant, TN (United States); Science Applications International Corp., Oak Ridge, TN (United States). May 1993. 393p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400 ;AC05-76OR00001. (Y/ER/SUB–91-99069/1/R3). Order Number DE93018593. Source: OSTI; NTIS; INIS; GPO Dep.

The enactment of the Resource Conservation and Recovery Act (RCRA) in 1976 and the Hazardous and Solid Waste Amendments (HSWA) to RCRA in 1984 created management requirements for hazardous waste facilities. The facilities within the Oak Ridge Reservation (ORR) were in the process of meeting the RCRA requirements when ORR was placed on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) National Priorities List (NPL) on November 21, 1989. Under RCRA, the actions typically follow the RCRA Facility Assessment (RFA)/RCRA Facility Investigation (RFI)/Corrective Measures Study (CMS)/Corrective Measures implementation process. Under CERCLA the actions follow the PA/SI/Remedial Investigation (RI)/Feasibility Study (FS)/Remedial Design/Remedial Action process. The development of this document will incorporate requirements

under both RCRA and CERCLA into an RI work plan for the characterization of Bear Creek Valley (BCV) Operable Unit (OU) 2.

32551 (DOE/OR/21949–368) **Colonie Interim Storage Site environmental report for calendar year 1992, 1130 Central Avenue, Colonie, New York: Formerly Utilized Sites Remedial Action Program (FUSRAP).** Bechtel National, Inc., Oak Ridge, TN (United States). May 1993. 193p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-91OR21949. Order Number DE93018600. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the environmental surveillance program at the Colonie Interim Storage Site (CISS) and provides the results for 1992. The site is located in eastern New York State, approximately 6.4 km (4.0 mi) northwest of downtown Albany. From 1958 to 1984, National Lead (NL) Industries used the facility to manufacture various components from depleted and enriched uranium natural thorium. Environmental monitoring of CISS began in 1984 when Congress added, the site to the US Department of Energy's (DOE) Formerly Utilized Sites Remedial Action Program (FUSRAP). FUSRAP is a program established to identify and decontaminate or otherwise control sites where residual radioactive materials remain from the early years of the nation's atomic energy program or from commercial operations causing conditions that Congress has authorized DOE to remedy. The environmental surveillance program at CISS includes sampling networks for external gamma radiation exposure and for thorium-232 and total uranium concentrations in surface water, sediment, and groundwater. Several chemical parameters are also measured in groundwater, including total metals, volatile organics, and water quality parameters. This surveillance program assists in fulfilling the DOE policy of measuring and monitoring effluents from DOE activities and calculating hypothetical doses. Results are compared with applicable Environmental Protection Agency (EPA) and New York State Department of Environmental Conservation (NYSDEC) standards, DOE derived concentration guides (DCGs), dose limits, and other DOE requirements.

32552 (DOE/OR/21949–369) **Hazelwood Interim Storage Site environmental report for calendar year 1992, 9200 Latty Avenue, Hazelwood, Missouri.** Bechtel National, Inc., Oak Ridge, TN (United States). May 1993. 159p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-91OR21949. Order Number DE93018338. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the environmental surveillance program at the Hazelwood Interim storage Site (HISS) and surrounding area, provides the results for 1992, and discusses applicable environmental standards and requirements with which the results were compared. HISS is located in eastern Missouri in the City of Hazelwood (St. Louis County) and occupies approximately 2.2 ha (5.5 acres). Environmental monitoring of HISS began in 1984 when the site was assigned to the US Department of Energy (DOE) as part of the decontamination research and development project authorized by Congress under the 1984 Energy and Water Development Appropriations Act. DOE placed responsibility for HISS under the Formerly Utilized Sites Remedial Action Program (FUSRAP), which was established to identify and decontaminate or otherwise control sites where residual radioactive materials remain from the early years of the nation's atomic energy program or from commercial operations causing conditions that Congress has authorized DOE to remedy. In 1992 there were no environmental occurrences or unplanned contaminant releases as defined in DOE requirements and in the Superfund Amendment and Reauthorization Act (SARA) Title III of CERCLA.

32553 (DOE/OR/21971–T1) **Site-specific earthquake response analysis for Paducah Gaseous Diffusion Plant, Paducah, Kentucky: Final report.** Sykora, D.W.; Davis, J.J. Army Engineer Waterways Experiment Station, Vicksburg, MS (United States). Geotechnical Lab. Aug 1993. 264p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI05-91OR21971. Order Number DE93040978. Source: OSTI; NTIS; GPO Dep.

The Paducah Gaseous Diffusion Plant (PGDP), owned by the US Department of Energy (DOE) and operated under contract by Martin Marietta Energy systems, Inc., is located southwest of Paducah, Kentucky. An aerial photograph and an oblique sketch of the plant are shown in Figures 1 and 2, respectively. The fenced portion of the plant consists of 748 acres. This plant was constructed in the 1950's and is one of only two gaseous diffusion plants in operation in the United States; the other is located near Portsmouth, Ohio. The facilities at PGDP are currently being evaluated for safety in response to natural seismic hazards. Design and evaluation guidelines to evaluate the effects of earthquakes and other natural hazards on DOE facilities follow probabilistic hazard models that have been outlined by Kennedy et al. (1990). Criteria also established by Kennedy et al. (1990) classify diffusion plants as "moderate hazard" facilities. The US Army Engineer Waterways Experiment Station (WES) was tasked to calculate the site response using site-specific design earthquake records developed by others and the results of previous geotechnical investigations. In all, six earthquake records at three hazard levels and four individual and one average soil columns were used.

32554 (DOE/OR/21981–T1) **Tennessee Health Studies Agreement: Annual report for year 1, August 15, 1991–December 31, 1992.** Tennessee Dept. of Health, Nashville, TN (United States). Mar 1993. 288p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-91OR21981. Order Number DE93018148. Source: OSTI; NTIS; GPO Dep.

Since I the early 1940's the US Department of Energy has operated a nuclear research and production facility in Oak Ridge, Tennessee. The three facilities (Y-12, ORNL, and K-25) represent sources of chemical and radionuclide releases to the air, water, and land. On May 13, 1991 the Tennessee Department of Environment and Conservation entered into an agreement with the DOE to assure the citizens of the sate of Tennessee that their health, safety, and environment are protect. This agreement, the Tennessee Oversight Agreement, included an action item to evaluate the effect of chemical and radionuclide releases on the off-site populations living in regions surrounding the Oak Ridge Reservation. This need resulted in the State entering into a separate agreement referred to as the Health Studies Agreement. The Health Studies Agreement is a five-year agreement, the text of which outlines five objectives for the first year are: Firstly the Commissioner of Health for the State of Tennessee shall appoint a technical panel to assist the State in writing a Request for Proposal for a dose reconstruction feasibility study and in reviewing the proposals submitted; secondly the Commissioner of Health for the State of Tennessee shall create a steering panel to initiate, direct and oversee the feasibility study for dose reconstruction, to determine the need for other health related studies, and to communicate project plans and results to the community; thirdly the Steering Panel shall determine the feasibility of reconstructing the doses of chemicals and radionuclides released from the ORR for the purpose of assessing the health risks to, off-site populations; fourthly the State shall enhance the Cancer Registry and develop a statewide Birth Defects Registry; and fifthly the Steeri.

32555 (DOE/RL–88-41-Rev.2-Vol.1) **2101-M pond closure plan: Volume 1, Revision 2.** USDOE Richland Operations Office, WA (United States). Jun 1993. 1426p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93019307. Source: OSTI; NTIS; INIS; GPO Dep.

This document describes activities for the closure of a surface impoundment (2101-M Pond) at the Hanford Site. The 2101-H Pond was initially constructed in 1953 to serve as a drainage collection area for the 2101-H Building. (Until the Basalt Waste Isolation Project (BWIP) Laboratory was constructed in the 2101-M Building in 1979–1981, the only source contributing discharge to the pond was condensate water from the 2101-H Building heating, ventilation, and air conditioning (HVAC) system. The drains for the BWIP Laboratory rooms were plumbed into a 4-in., cast-iron, low-pressure drain pipe that carries waste water from the HVAC system to the pond. During the active life of the BWIP Laboratory, solutions of dissolved barium in groundwater samples were discharged to the 2101-M Pond via the laboratory drains. As a result of the discharges, a Part A permit application was initially submitted to the Washington State Department of Ecology (Ecology) in August 1986 which designates the 2101-M Pond as a surface impoundment.

32556 (EGG-EEL–10794) **Elevation of surficial sediment/basalt contact in the Subsurface Disposal Area, Idaho National**

Engineering Laboratory. Hubbell, J.M. EG and G Idaho, Inc., Idaho Falls, ID (United States). 13 May 1993. 60p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93018934. Source: OSTI; NTIS; INIS; GPO Dep.

The elevation of the surficial sediment/basalt contact at the Subsurface Disposal Area (SDA), within the Radioactive Waste Management Complex (RWMC) is presented to provide a data base for future remedial actions at this site. About 1,300 elevation data from published and unpublished reports, maps, and surveyors notes were compiled to generate maps and cross-sections of the surficial sediment/basalt contact. In general, an east to west trending depression exists in the south central portion of the SDA with basalt closer to land surface on the northern and southern boundaries of the SDA. The lowest elevation of the surficial sediment/basalt contact is 4,979 ft and the greatest is land surface at 5,012 ft. The median elevation of the sediment/basalt interface is 4,994 ft. The median depth to basalt in the SDA is 16 ft if land surface elevation is assumed to be 5,010 ft. The depth from land surface to the sediment/basalt interface ranges from 24 ft in the southeast corner of the SDA to less than 3 ft at the north-central boundary of the SDA.

32557 (EGG-M–93238) **The United States Department of Energy (DOE) Computerized Accident/Incident Reporting System (CAIRS).** Briscoe, G.J. EG and G Idaho, Inc., Idaho Falls, ID (United States). 7 Jun 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-9307103–2: 11. international system safety conference, Cincinnati, OH (United States), 28 Jul - 2 aug 1993). Order Number DE93018942. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy's (DOE) Computerized Accident/Incident Reporting System (CAIRS) is a comprehensive data base containing more than 50,000 investigation reports of injury/illness, property damage and vehicle accident cases representing safety data from 1975 to the present for more than 150 DOE contractor organizations. A special feature is that the text of each accident report is translated using a controlled dictionary and rigid sentence structure called Factor Relationship and Sequence of Events (FRASE) that enhances the ability to retrieve specific types of information and to perform detailed analyses. DOE summary and individual contractor reports are prepared quarterly and annually. In addition, "Safety Performance Profile" reports for individual organizations are prepared to provide advance information to appraisal teams, and special topical reports are prepared for areas of concern such as an increase in the number of security injuries or environmental releases. The data base is open to all DOE and Contractor registered users with no access restrictions other than that required by the Privacy Act.

32558 (EGG-M–93309) **Systems engineered health and safety criteria for safety analysis reports.** Beitel, G.A.; Morcos, N. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-931160–16: American Nuclear Society (ANS) winter meeting, San Francisco, CA (United States), 14-19 Nov 1993). Order Number DE93018999. Source: OSTI; NTIS; GPO Dep.

The world of safety analysis is filled with ambiguous words: codes and standards; consequences and risks; hazard and accident, and health and safety. These words have been subject to disparate interpretations by Safety Analysis Report (SAR) writers, readers and users. "Principal health and safety criteria" has been one of the most frequently misused terms; rarely is it used consistently or effectively. This paper offers an easily understood definition for "principal health and safety criteria," and uses systems engineering to convert an otherwise mysterious topic into the primary means of producing an integrated SAR. This paper is based upon SARs being written for Environmental Restoration & Waste Management activities for the Department of Energy (DOE). Requirements for these SARs are prescribed in DOE Order 5480.23, "Nuclear Safety Analysis Reports".

32559 (EGG-WTD–10716) **Test Plan for the overburden removal demonstration.** Rice, P. (EG and G Idaho, Inc., Idaho Falls, ID (United States)); Thompson, D.; Winberg, M.; Skaggs, J. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jun 1993. 73p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93018990. Source: OSTI; NTIS; INIS; GPO Dep.

The removal of soil overburdens from contaminated pits and trenches involves using equipment that will remove a small layer of soil from 3 to 6 in. at any time. As a layer of soil is removed, overburden characterization techniques perform surveys to a depth that exceeds each overburden removal layer to ensure that the removed soil will be free of contamination. It is generally expected that no contamination will be found in the soil overburden, which was brought in after the waste was put in place. It is anticipated that some containers in the waste zone have lost their integrity, and the waste leakage from those containers has migrated by gravity downward into the waste zone. To maintain a safe work environment, this method of overburden removal should allow safe preparation of a pit or trench for final remediation. To demonstrate the soil overburden techniques, the Buried Waste Integrated Demonstration Program has contracted vendor services to provide equipment and techniques demonstrating soil overburden removal technology. The demonstration will include tests that will evaluate equipment performance and techniques for removal of overburden soil, control of contamination spread, and dust control. To evaluate the performance of these techniques, air particulate samples, physical measurements of the excavation soil cuts, maneuverability measurements, and time versus volume (rate) of soil removal data will be collected during removal operations. To provide a medium for sample evaluation, the overburden will be spiked at specific locations and depths with rare earth tracers. This test plan will be describe the objectives of the demonstration, data quality objectives, methods to be used to operate the equipment and use the techniques in the test area, and methods to be used in collecting data during the demonstration.

32560 (ES/CSET–18) **Safety study application guide: Safety Analysis Report Update Program.** Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States). Jul 1993. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93017990. Source: OSTI; NTIS; INIS; GPO Dep.

Martin Marietta Energy Systems, Inc., (Energy Systems) is committed to performing and documenting safety analyses for facilities it manages for the Department of Energy (DOE). Included are analyses of existing facilities done under the aegis of the Safety Analysis Report Upgrade Program, and analyses of new and modified facilities. A graded approach is used wherein the level of analysis and documentation for each facility is commensurate with the magnitude of the hazard(s), the complexity of the facility and the stage of the facility life cycle. Safety analysis reports (SARs) for hazard Category 1 and 2 facilities are usually detailed and extensive because these categories are associated with public health and safety risk. SARs for Category 3 are normally much less extensive because the risk to public health and safety is slight. At Energy Systems, safety studies are the name given to SARs for Category 3 (formerly "low") facilities. Safety studies are the appropriate instrument when on-site risks are limited to irreversible consequences to a few people, and off-site consequences are limited to reversible consequences to a few people. This application guide provides detailed instructions for performing safety studies that meet the requirements of DOE Orders 5480.22, "Technical Safety Requirements," and 5480.23, "Nuclear Safety Analysis Reports." A seven-chapter format has been adopted for safety studies. This format allows for discussion of all the items required by DOE Order 5480.23 and for the discussions to be readily traceable to the listing in the order. The chapter titles are: (1) Introduction and Summary, (2) Site, (3) Facility Description, (4) Safety Basis, (5) Hazardous Material Management, (6) Management, Organization, and Institutional Safety Provisions, and (7) Accident Analysis.

32561 (ES/ER/TM–1/R2) **Applicable or Relevant and Appropriate Requirements (ARARs) for Remedial Action at the Oak Ridge Reservation: A compendium of major environmental laws: Environmental Restoration Program.** Etnier, E.L.; McDonald, E.P.; Houlberg, L.M. Oak Ridge National Lab., TN (United States). Jul 1993. 85p. Sponsored by USDOE, Washington, DC

(United States). DOE Contract AC05-84OR21400 ;AC05-76OR00001. Order Number DE93017754. Source: OSTI; NTIS; INIS; GPO Dep.

Section 121 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 specifies that remedial actions for cleanup of hazardous substances must comply with applicable or relevant and appropriate requirements (ARARS) or standards under federal and state environmental laws. The US Department of Energy (DOE) Oak Ridge Reservation (ORR) was placed on the National Priorities List by the US Environmental Protection Agency (EPA) on November 21, 1989, effective December 21, 1989. As a result of this listing, DOE, EPA, and the Tennessee Department of Environment and Conservation have signed a Federal Facility Agreement (FFA) for the environmental restoration of the ORR. Section XXI(F) of the FFA calls for the preparation of a draft listing of all ARARs as mandated by CERCLA §121. This report supplies a preliminary list of available federal and state ARARs that might be considered for remedial response at the ORR. A description of the terms "applicable" and "relevant and appropriate" is provided, as well as definitions of chemical-, location-, and action-specific ARARS. ARARs promulgated by the federal government and by the state of Tennessee are listed in tables. In addition, the major provisions of the Resource Conservation and Recovery Act, the Safe Drinking Water Act, the Clean Water Act, the Clean Air and other acts, as they apply to hazardous waste cleanup, are discussed. In the absence of ARARS, CERCLA §121 provides for the use of nonpromulgated federal criteria, guidelines, and advisories in evaluating the human risk associated with remedial action alternatives. Such nonpromulgated standards are classified as "to-be-considered" (TBC) guidance. A ion of available guidance is given; summary tables fist the available federal standards and guidance information. In addition, the substantive contents of the DOE orders as they apply to remediation of radioactively contaminated sites are discussed as TBC guidance.

32562 (FEMP–2290) **1992 Fernald Site Environmental Report.** Fernald Environmental Restoration Management Corp., Cincinnati, OH (United States). Fernald Environmental Management Project. Jun 1993. 259p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-92OR21972. Order Number DE93019497. Source: OSTI; NTIS; INIS; GPO Dep.

The Fernald site is a Department of Energy (DOE) owned facility that produced high-quality uranium metals for military defense for nearly 40 years. DOE suspended production at the Fernald site in 1989 and formally ended production in 1991. Although production activities have ceased, the site continues to examine the air and liquid pathways as possible routes through which pollutants from past operations and current remedial activities may leave the site. This report covers the reporting period from January 1, 1992, through December 31, 1992, with the exception of Chapter Three, which provides information from the first quarter of 1993 as well as calendar year 1992 information. This 1992 report provides the general public as well as scientists and engineers with the results from the site's ongoing Environmental Monitoring Program. Use included in this report are summary data of the sampling conducted to determine if the site complies with DOE, US Environmental Protection Agency (USEPA), and Ohio EPA (OEPA) requirements. Finally, this report provides general information on the major waste management and environmental restoration activities during 1992.

32563 (HW–70700) **Serious radiation event - Hanford capabilities.** Keene, A.R.; Unruh, C.M.; Backman, G.E.; Carter, L.A. Hanford Works, Richland, WA (United States). 15 Aug 1961. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93017377. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The need for an industrial plant to know its capabilities to rescue personnel and minimize damage to vital operating equipment in the event of a serious accident has long been recognized. Although Hanford's experience has been without a serious radiation event as characterized in this report, it is prudent to have an objective assessment of the capabilities which do exist and an analysis of the general capabilities which the plant should possess to maximize the effectiveness of rescue action in such an event and to limit the consequences to personnel, vital equipment, and the surrounding environs. It in the purpose of this report to: (1) make an assessment of the capabilities which are currently in place at Hanford to handle the multitude of serious problems arising from a serious radiation event; and (2) define the level of capability which the Hanford Atomic Products Operation should possess to minimize the consequences of such an accident. It is not the intent of this presentation to discuss the possibilities, probabilities, prevention or courses of serious radiation events.

32564 (INIS-mf–13676, pp. Z11.1-Z11.9) **Radiation burden of the population in the Doini Rozinka mining region.** Placek, V. (Ustav Hygieny Prace v Uranovem Prumyslu, Pribram (Czech Republic)). Ceskoslovensky Uranovy Prumsl, Pribam (Czech Republic). 1992. (In Czech). (CONF-9210351–: The mining town of Pribram in science and technology, Pribram (Czechoslovakia), 12-14 Oct 1992). In *Mining and the environment.* 168p. Order Number DE93633757. Source: OSTI; NTIS (US Sales Only); INIS.

English translation available from Nuclear Information Center, 156 16 Prague-Zbraslav, Czech Republic, at USD 10.- per typewritten page.

The various sources of radiation exposure of people living in the vicinity of the uranium mine, and the associated health hazards are dealt with. The sources include updraft from air shafts from radon-containing mines, waste banks, ore transport routes, mine and mill waters, and mill tailings settling ponds. No significant increase in the exposure level above the natural background was found. To secure efficient protection of the population it is recommended that the existing monitoring system should be extended with the measurement of the photon dose equivalent, volume activities of radionuclides in flue dust, amount of atmospheric precipitation, and soil and vegetation samples in health protection zones of the settling ponds; moreover, land reclamation activities should be promoted. (M.D.). 17 refs.

32565 (LA-UR–93-2516) **High gradient magnetic separation applied to environmental remediation.** Prenger, F.C. (Los Alamos National Lab., NM (United States)); Stewart, W.F.; Hill, D.D.; Avens, L.R.; Worl, L.A.; Schake, A.; de Aguero, K.J.; Padilla, D.D.; Tolt, T.L. Los Alamos National Lab., NM (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930703–14: International cryogenic engineering conference and international cryogenic materials conference, Albuquerque, NM (United States), 12-16 Jul 1993). Order Number DE93018372. Source: OSTI; NTIS; INIS; GPO Dep.

High Gradient Magnetic Separation (HGMS) is an application of superconducting magnet technology to the separation of magnetic solids from other solids, liquids, or gases. The production of both high magnetic fields (>4 T) and large field gradients using superconducting magnet technology has made it possible to separate a previously unreachable but large family of paramagnetic materials. This is a powerful technique that can be used to separate widely dispersed contaminants from a host material and may be the only technique available for separating material in the colloidal state. Because it is a physical separation process, no additional waste is generated. We are applying this technology to the treatment of radioactive wastes for environmental remediation. We have conducted tests examining slurries containing nonradioactive, magnetic surrogates. Results from these studies were used to verify our analytical model of the separation process. The model describes the rate process for magnetic separation and is based on a force balance on the paramagnetic species. This model was used to support bench scale experiments and prototype separator design.

32566 (ORNL/ER/Sub–87-99053/3/R1) **Environmental, Safety, and Health Plan for the remedial investigation/feasibility study at Oak Ridge National Laboratory, Oak Ridge, Tennessee: Revision 1, Environmental Restoration Program.** Oak Ridge National Lab., TN (United States); Bechtel National, Inc., Oak Ridge, TN (United States). May 1993. 109p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93016367. Source: OSTI; NTIS; INIS; GPO Dep.

This Environmental, Safety, and Health (ES&H) Plan presents the concepts and methodologies to be followed during the remedial

investigation/feasibility study (RI/FS) for Oak Ridge National Laboratory (ORNL) to protect the health and safety of employees, the public, and the environment. This ES&H Plan acts as a management extension for ORNL and Martin Marietta Energy Systems, Inc. (Energy Systems) to direct and control implementation of the project ES&H program. The subsections that follow describe the program philosophy, requirements, quality assurance measures, and methods for applying the ES&H program to individual waste area grouping (WAG) remedial investigations. Hazardous work permits (HWPs) will be used to provide task-specific health and safety requirements.

32567 (ORNL/FTR–4611) **An environmental restoration project incorporating the bidirectional (US-Germany) transfer of environmental management technologies and inspection of the confirmed technology demonstration site: Foreign trip report, April 12–18, 1993.** Faison, B.D. Oak Ridge National Lab., TN (United States). 17 May 1993. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93014660. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The traveler attended meetings at Chemnitz and Leipzig to formalize a cooperative agreement with Ogden Environmental and Energy Services, Inc. (a US company) aimed at the restoration of sites contaminated by uranium milling activities near Ronneburg. Technologies developed at ORNL and DFA to be implemented in the restoration were described, with emphasis on biosorption to remove dissolved uranium from mine drainage (ORNL) and bioprecipitation to remove dissolved sulfate and heavy metals from the treated water (DFA). Organizational ties were established with WISMUT, the site operator, to facilitate work at this specific site. Specific roles for DFA and Ogden were confirmed. A basis for cooperation with a German national laboratory – Leipzig-Halle (UFZ) – was discussed.

32568 **System to control contamination during retrieval of buried TRU waste.** Menkhaus, D.E.; Loomis, G.G.; Feldman, E.M.; Scott, D.W.; Mullen, C.K.; Meyer, L.C. To Dept. of Energy. 1991. USA patent application 7-751,900. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93019323. Source: OSTI; NTIS; INIS; GPO Dep.

Between 1950 and 1970 the Department of Energy's Rocky Flats Plant generated transuranic (TRU) contaminated waste, which was buried at the Idaho National Engineering Laboratory. This waste must now be retrieved and sent to a permanent disposal site. During retrieval the main contaminates to be controlled are compounds of plutonium and americium. Since these substances are small sized, and extremely mobile, airborne concentrations must be kept to a minimum to effectively eliminate personnel uptake during retrieval operations. This report describes an invention that relates to a system to control contamination due to TRU airborne particles and was developed consisting of an outer containment building, an inner containment area, a dust suppression system including an electrostatic contaminate capture subsystem, a contamination control system including a moisture control subsystem, a rapid monitoring subsystem, and a lifting and moving system including recovery and repackaging subsystems, and a lifting and moving system including recovery and repackaging subsystems.

32569 (PNL–8477) **Strategy to develop and test a multi-function scarifier end effector with an integral conveyance system for waste tank remediation: Strategy plan.** Bamberger, J.A.; Bates, J.M.; Keska, J.K.; Elmore, M.R.; Lombardo, N.J. Pacific Northwest Lab., Richland, WA (United States). Aug 1993. 90p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93040111. Source: OSTI; NTIS; INIS; GPO Dep.

This strategy plan describes a coupled analytical/experimental approach to develop a multi-functional scarifier end effector coupled with a pneumatic conveyance system to retrieve wastes from underground storage tanks. The scarifier uses ultra-high-pressure water jets to rubblize and entrain waste forms such as salt cake, sludge, and viscous liquid that can be transported pneumatically. The three waste types (hard, brittle, salt cake, viscous liquid, and deformable sludge) present increasingly complex challenges for scarification and pneumatic conveyance. Salt cake is anticipated to be the easiest to retrieve because (1) a theoretical model of hydraulic rock fracture can be applied to estimate jet performance to fracture salt cake, and (2) gas-solids transport correlations can be used to predict pneumatic transport. Deformable sludge is anticipated to be the most difficult to retrieve: no theories, correlations, or data exist to predict this performance. However order-of-magnitude gas-solid correlations indicate particulate wastes of prototypic density can be transported to a height of 20 m within allowable pressure limits provided that the volume fraction of the gaseous phase is kept above 95%. Viscous liquid is anticipated to be of intermediate complexity to retrieve. Phenomena that are expected to affect system performance are ranked. Experiments and analyses necessary to evaluate the effects of these phenomena are proposed. Subsequent strategies for experiment test plans, system deployment, and operation and control will need to be developed.

32570 (PNL-SA–21495) **Risk assessment framework of fate and transport models applied to hazardous waste sites.** Hwang, S.T. Pacific Northwest Lab., Richland, WA (United States). Jun 1993. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930647–8: 86. annual meeting and exhibition of the Air and Waste Management Association (AWMA), Denver, CO (United States), 13-18 Jun 1993). Order Number DE93017606. Source: OSTI; NTIS; INIS; GPO Dep.

Risk assessment is an increasingly important part of the decision-making process in the cleanup of hazardous waste sites. Despite guidelines from regulatory agencies and considerable research efforts to reduce uncertainties in risk assessments, there are still many issues unanswered. This paper presents new research results pertaining to fate and transport models, which will be useful in estimating exposure concentrations and will help reduce uncertainties in risk assessment. These developments include an approach for (1) estimating the degree of emissions and concentration levels of volatile pollutants during the use of contaminated water, (2) absorption of organic chemicals in the soil matrix through the skin, and (3) steady state, near-field, contaminant concentrations in the aquifer within a waste boundary.

32571 (PNL-SA–22046) **Lessons learned from the Hanford Mission Planning Program.** Stillwell, W.G. (Pacific Northwest Lab., Richland, WA (United States)); Madden, M.S.; Keller, J.F.; Fassbender, L.; Hesser, A.; Honeyman, J.O.; Bixby, W. Pacific Northwest Lab., Richland, WA (United States). Feb 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930205–48: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 mar 1993). Order Number DE93010170. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the management activities and decision making processes involved in the Hanford Reservation remedial action activities.

32572 (RFP–4717) **The Rocky Flats Plant Independent Safety Review system: An implementation of DOE 5480.5, 5480.6, and 5482.1B.** Croucher, D.W. EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant. [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC34-90DP62349. (CONF-9306143–15: Energy Facility Contractors Group safety analysis meeting, Denver, CO (United States), 16-18 Jun 1993). Order Number DE93015413. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. ROCKY FLATS PLANT/occupational safety; MANAGEMENT; RECOMMENDATIONS

32573 (RFP–4720) **The safety climate of a Department of Energy nuclear facility: A sociotechnical analysis.** Johnson, A.E.; Harbour, J.L. EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant. [1993]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC34-90DP62349. (CONF-9310100–1: Human Factors and Ergonomics Society meeting, Seattle, WA (United States), 11-15 Oct 1993). Order Number DE93015409. Source: OSTI; NTIS; INIS; GPO Dep.

Government- and public-sponsored groups are increasingly demanding greater accountability by the Department of Energy's weapons complex. Many of these demands have focused on the development of a positive safety climate, one that not only protects workers onsite, but also the surrounding populace and environment

as well. These demands are, in part, a response to findings which demonstrate a close linkage between actual organizational safety performance and the organization's safety climate, i.e., the collective attitudes employees hold concerning the level of safety in their organization. This paper describes the approach taken in the systematic assessment of the safety climate at EG&G Rocky Flats Plant (RFP).

32574 (RFP–4725) **Systematic Evaluation Program (SEP) at Rocky Flats Plant: An overview of practical management issues for evaluation of natural phenomena hazards.** Badwan, F.M. (EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant); Herring, K.S. EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant. [1993]. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC34-90RF62349. (CONF-9310102–4: 4. energy natural phenomena hazards mitigation conference, Atlanta, GA (United States), 19-22 Oct 1993). Order Number DE93018798. Source: OSTI; NTIS; INIS; GPO Dep.

Many of the buildings at the Rocky Flats Plant were designed and built before modern standards were developed, including standards for protection against extreme natural phenomenon such as tornadoes, earthquakes, and floods. The purpose of the SEP is to establish an integrated approach to assessing the design adequacy of specific high and moderate hazard Rocky Flats facilities from a safety perspective and to establish a basis for defining any needed facility improvements. The SEP is to be carried out in three Phases. In Phase 1, topics to be evaluated and an evaluation plan for each topic were developed. Any differences between Current Design Requirements (CDR) or acceptance criteria and the design of existing facilities, will be identified during Phase 2 and assessed using an integrated systematic approach during Phase 3. The integrated assessment performed during Phase 3 provides a process for evaluating the differences between existing facility design and CDRs so that decisions on corrective actions can be made on the basis of relative risk reduction and cost effectiveness. These efforts will ensure that a balanced and integrated level of safety is achieved for long-term operation of these buildings. Through appropriate selection of topics and identification of the structures, systems, and components to be evaluated, the SEP will address outstanding design issues related to the prevention and mitigation of design basis accidents, including those arising from natural phenomena. The objective of the SEP is not to bring these buildings into strict compliance with current requirements, but rather to ensure that an adequate level of safety is achieved in an economical fashion.

32575 (SAND–92-2035-Vol.1-Chg.1) **Final consolidated action plan to Tiger Team: Volume 1, Change 1.** Sandia National Labs., Albuquerque, NM (United States). 1 Apr 1993. 150p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93014109. Source: OSTI; NTIS; GPO Dep.

Two separate Tiger Team assessments were conducted at Sandia National Laboratories (SNL). The first was conducted at the California site in Livermore between April 30, 1990, and May 18, 1990. A second Tiger team assessment was conducted at the New Mexico site in Albuquerque between April 15 and May 24, 1991. One purpose of this Action Plan is to provide a formal written response to each of the findings and/or concerns cited in the SNL Tiger Team assessment reports. A second purpose is to present actions planned to be conducted to eliminate deficiencies identified by the Tiger Teams. A third purpose is to consolidate (group) related findings and to identify priorities assigned to the planned actions for improved efficiency and enhanced management of the tasks. A fourth and final purpose is to merge the two original SNL Action Plans for the New Mexico and California sites into a single Action Plan as a major step toward managing all SNL ES&H activities more similarly. Included in this combined SNL Action Plan are descriptions of the actions to be taken by SNL to liminate all problems identified in the Tiger Teams' findings/concerns, as well as estimated costs and schedules for planned actions.

32576 (SAND–92-2035-Vol.2-Chg.1) **Final consolidated action plan to Tiger Team: Volume 2, Change 1.** Sandia National Labs., Albuquerque, NM (United States). 1 Apr 1993. 242p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93014300. Source: OSTI; NTIS; GPO Dep.

Two separate Tiger Team assessments were conducted at Sandia National Laboratories (SNL). The first was conducted at the California site in Livermore between April 30, 1990, and May 18, 1990. A second Tiger Team assessment was conducted at the New Mexico site in Albuquerque between April 15 and May 24, 1991. This report is volume two, change one. One purpose of this Action Plan is to provide a formal written response to each of the findings and/or concerns cited in the SNL Tiger Team assessment reports. A second purpose is to present actions planned to be conducted to eliminate deficiencies identified by the Tiger Teams. A third purpose is to consolidate (group) related findings and to identify priorities assigned to the planned actions for improved efficiency and enhanced management of the tasks. A fourth and final purpose is to merge the two original SNL Action Plans for the New Mexico [Ref. a] and California [Ref. b] sites into a single Action Plan as a major step toward managing all SNL ES&H activities more similarly. Included in this combined SNL Action Plan are descriptions of the actions to be taken by SNL to liminate all problems identified in the Tiger Teams' findings/concerns, as well as estimated costs and schedules for planned actions.

32577 (SAND–93-1403C) **Remediating hazardous waste robotically using a high-level control system and real-time sensors.** Davies, B.R. Sandia National Labs., Albuquerque, NM (United States). 1 Jul 1993. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9309199–1: Society of Photo-Optical Instrumentation Engineer's (SPIE) international symposium on optical tools for manufacturing and advanced automation, Boston, MA (United States), 7-10 Sep 1993). Order Number DE93017490. Source: OSTI; NTIS; GPO Dep.

Robotics technology is being developed to assist in remediating high-level radioactive wastes stored in large tanks at the Department of Energy's Hanford, Washington facility. Remediation activities will likely employ a remotely controlled long reach manipulator, capable of extending over 40 feet from its base, to deploy remediation end-effectors and sensors. Waste inside the tanks consists of hazardous vapor, liquid, sludge, solidified crystal, and various steel pipes and miscellaneous hardware. On November 10–12, 1992, a demonstration by Sandia National Laboratories of environmental sensor scanning and robot manipulated steel pipe cutting was performed on a tank mockup located at the Hanford facility. This paper describes the Sandia developed technology implemented at this demonstration.

32578 (WHC-EP–0474-08) **Quarterly report on Defense Nuclear Facilities Safety Board Recommendation 90-7 for the period ending March 31, 1993.** Cash, R.J.; Dukelow, G.T.; Forbes, C.J.; Meacham, J.E. Westinghouse Hanford Co., Richland, WA (United States). Jun 1993. 110p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93040340. Source: OSTI; NTIS; GPO Dep.

This is the eighth quarterly report on the progress of activities addressing safety issues associated with Hanford Site high-level radioactive waste tanks that contain ferrocyanide compounds. In the presence of oxidizing materials, such as nitrates or nitrites, ferrocyanide can be made to explode in the laboratory by heating it to high temperatures [above 285°C (545°F)]. In the mid 1950s, approximately 140 metric tons of ferrocyanide were added to 24 underground high-level radioactive waste tanks. An implementation plan (Cash 1991) responding to the Defense Nuclear Facilities Safety Board Recommendation 90-7 (FR 1990) was issued in March 1991 describing the activities that were planned and underway to address each of the six parts of Recommendation 90-7. A revision to the original plan was transmitted to the US Department of Energy by Westinghouse Hanford Company in December 1992.

32579 (WHC-SD-EN-TI–120) **Feasibility of the Shallow High Resolution Seismic Reflection Technique for Use at the Hanford Site.** S.M., Narbutovskih. Westinghouse Hanford Co., Richland, WA (United States). 30 Jul 1993. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018747. Source: OSTI; NTIS; INIS; GPO Dep.

Data obtained during site characterization should be useful to assess the need for remediation, to evaluate and design effective remedial plans, and to allow long-term monitoring to discern remediation effectiveness. A valuable environmental tool that incorporates this data is a model that describes groundwater and vadose zone flow and transport characteristics. Data on geology and hydrology combined with information on contaminant sources are incorporated into these conceptual models that delineate the relative significance of the various fluid migration pathways. Downstream these same models also support risk assessment, remediation design, and long-term assessment of remediation effectiveness. Consequently, the building of coherent, accurate vadose zone and groundwater models is fundamental to a successful remediation. Among the important requirements for these models is accurate knowledge of flow domain boundaries and soil characteristics. At the Hanford Site, this knowledge is obtained primarily from borehole data, which provides information only at a point. In the high energy flood and fluvial deposits found at the Hanford Site, it can, at times, be difficult to correlate lithologic horizons between boreholes. Where there is no borehole control, our understanding of the geometry of hydrogeologic boundaries and thus of fluid migration paths is limited. Surface geophysical techniques are generally used to provide a measure of geologic control between boreholes. In particular, the seismic reflection method has the potential to provide the greatest resolution of the subsurface hydrogeology between and beyond boreholes.

32580 (WHC-SD-EN-TI-172) **Data validation summary report 300-FF-5 round 5 groundwater.** Hulstrom, L.C. Hanford Engineering Development Lab., Richland, WA (United States). 15 Jul 1993. 66p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018743. Source: OSTI; NTIS; GPO Dep.

Laboratory data for Fifth Round Groundwater samples collected during the 300-FF-5 Operable Unit Remedial Investigation have been reviewed and validated to ensure that they are of sufficient quality to support decisions regarding further actions to be taken at the 300-FF-5 Operable Unit. Table 1-1 is a summary of the validated samples. This report summarizes the results previously presented to Westinghouse Hanford in a series of Preliminary Quality Assurance Reports (PQAR) for the 300-FF-5 Fifth Round Groundwater samples. In some instances, the data qualifiers originally presented in the PQARs have been changed based upon further review of the data; these changes are highlighted in the text.

32581 (WINCO–1101) **Idaho Chemical Processing Plant safety document ICPP hazardous chemical evaluation.** Harwood, B.J. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Jan 1993. 81p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE93014822. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents the results of a hazardous chemical evaluation performed for the Idaho Chemical Processing Plant (ICPP). ICPP tracks chemicals on a computerized database, Haz Track, that contains roughly 2000 individual chemicals. The database contains information about each chemical, such as its form (solid, liquid, or gas); quantity, either in weight or volume; and its location. The Haz Track database was used as the primary starting point for the chemical evaluation presented in this report. The chemical data and results presented here are not intended to provide limits, but to provide a starting point for nonradiological hazards analysis.

32582 (WINCO–1124) **CPP-603 Chloride Removal System Decontamination and Decommissioning: Final report.** Moser, C.L. Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). Feb 1993. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Order Number DE93014827. Source: OSTI; NTIS; INIS; GPO Dep.

The CPP-603 (annex) Chloride Removal System (CRS) Decontamination and Decommissioning (D&D) Project is described in this report. The CRS was used for removing Chloride ions and other contaminants that were suspended in the waters of the underwater fuel storage basins in the CPP-603 Fuel Receiving and Storage Facility (FRSF) from 1975 to 1981. The Environmental Checklist and related documents, facility characterization, decision analysis', and D&D plans' were prepared in 1991. Physical D&D activities were begun in mid summer of 1992 and were completed by the end of November 1992. All process equipment and electrical equipment were removed from the annex following accepted asbestos and radiological contamination removal practices. The D&D activities were performed in a manner such that no radiological health or safety hazard to the public or to personnel at the Idaho National Engineering Laboratory (INEL) occurred.

32583 (WINCO–11921) **WINCO database program.** Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. (CONF-931144–1: EFCOG: Energy Facility Cooperative Group configuration management workshop, Boston, MA (United States), 1-2 Nov 1993). Order Number DE93014882. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. IDAHO CHEMICAL PROCESSING PLANT/risk assessment; FAILURES/data base management; EQUIPMENT/failures; FAILURES; HUMAN FACTORS; PROBABILITY; EDUCATIONAL FACILITIES; IDAHO; MONTANA; EQUIPMENT

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Refer also to citation(s) 32781, 33137, 33139

32584 (BNL–48554) **Preparing the 1993–94 Safeguards Implementation Support Programme for IAEA.** Green, L. Brookhaven National Lab., Upton, NY (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-930749–56: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93018671. Source: OSTI; NTIS; INIS; GPO Dep.

The 1993-94 Safeguards Implementation Support (IS) Program describes the Department of Safeguards' program of implementation support for the coming two years. The main body of the document describes the IS program for IAEA. A detailed description of the individual IS needs for 1993-1994 is contained in an annex that specifies the nee, assigns priorities and lists tasks and activities underway to address the need. Other annexes address policy and procedures for program planning and management, current Member State Support Programs (MSSP) tasks, and identification of MSSP resources required for implementation of developed technologies that could be provided. The primary responsibility for supporting the implementation of safeguards technology is with the support divisions of the Department of Safeguards. However, in this time of limited resources it is essential that, where possible, the Department receives assistance from MSSPs that have the needed resources. This document should serve as a guide for IAEA, in planning implementation support activities and for identifying tasks for MSSPs wishing to provide assistance.

32585 (BNL–48555) **Interactive computer-based instruction: Basic material control and accounting demonstration.** Keisch, B. Brookhaven National Lab., Upton, NY (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-930749–55: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93018669. Source: OSTI; NTIS; INIS; GPO Dep.

The use of interactive, computer-based training (CBT) courses can be a time- and resource-saving alternative to formal instruction in a classroom milieu. With CBT, students can proceed at their own pace, fit the study course into their schedule, and avoid the extra time and effort involved in travel and other special arrangements. The demonstration given here is an abbreviated, annotated version of a recently developed course in basic material control and accounting designed for the MC and A novice. The system used is "Quest" which includes multi-media capabilities, individual scoring, and built-in result-reporting capabilities for the course administrator. Efficient instruction and training are more important than ever because of the growing numbers of relatively inexperienced persons becoming active in safeguards.

32586 (BNL–48556) **Development of an SNM test source simulator.** Kane, W.R. Brookhaven National Lab., Upton, NY (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-930749–24: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93019043. Source: OSTI; NTIS; GPO Dep.

To optimize detection sensitivity and minimize the effects of ambient background radiation, portal monitors for the detection of special nuclear materials (SNM) are ordinarily calibrated to accept signals with amplitudes corresponding to the radiation emitted from the material to be detected and to reject those falling outside of this range. In the testing of portal monitors in service; it is best to utilize actual samples of the SNM to be detected (^{235}U or ^{239}Pu) since no other radioactive materials duplicate the gamma-ray spectra emitted by these nuclides, and a test with a check source emitting gamma rays with other energies may not necessarily disclose a de-calibration arising from gain drifts or other equipment malfunctions. The use of SNM samples for this purpose, however, may be impeded or even prevented by material control, security, and health and safety requirements. A user need has been identified for a gamma-ray source whose spectrum resembles closely that of a sample of ^{235}U or ^{239}Pu, but which in fact contains no SNM.

32587 (LA–12626-MS) **A portable, automatic SNM monitor for nuclear safeguards: Development, evaluation, and applications.** Fehlau, P.E. Los Alamos National Lab., NM (United States). Sep 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93018875. Source: OSTI; NTIS; INIS; GPO Dep.

The portable SNM monitor is a lightweight, full-size, automatic monitor, suitable for temporary service (such as demonstrations or for use during maintenance) or as a permanent replacement for hand- held monitors. The authors based the monitor on the TSA Systems, Ltd., modular SNM monitor design and, through evaluation and improvement of the commercial modules, obtained adequate sensitivity in a single- cabinet monitor that is easily portable. Complete monitoring of pedestrians with a single detector cabinet is achieved by requiring the pedestrian to stand in front of the detectors and turn around through 360 deg while being observed by a security inspector. The monitor is available commercially as the TSA Systems Model PMD-701, and it is beginning to be used in both temporary and permanent applications.

32588 (LA-UR–93-2218) **Safeguarding the Direct Use of Spent PWR Fuel in CANDU Reactors (DUPIC).** Thomas, K.E. (Los Alamos National Lab., NM (United States)); Hakkila, E.A.; Menlove, H.O.; Hong, J.S. Los Alamos National Lab., NM (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930913–20: Global '93: future nuclear systems - emerging fuel cycles and waste disposal options, Seattle, WA (United States), 12-17 Sep 1993). Order Number DE93018560. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the fuel cycle options under consideration for the Direct Use of PWR Spent Fuel in CANDU Reactors (DUPIC) satisfy the need to maximize the energy output of nuclear fuel while minimizing the potential for proliferation of separated plutonium. Several options have been considered including repacking options and thermal processing. Los Alamos has completed preliminary investigations of the safeguards aspects of the different processing options and the need for measurement development. Future safeguards activities will focus on the thermal-mechanical process selected for further development.

32589 (LA-UR–93-2538) **Integrated safeguards and security for a highly automated process.** Zack, N.R. (Los Alamos National Lab., NM (United States)); Hunteman, W.J.; Jaeger, C.D. Los Alamos National Lab., NM (United States). 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930749–47: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93018370. Source: OSTI; NTIS; INIS; GPO Dep.

Before the cancellation of the New Production Reactor Programs for the production of tritium, the reactors and associated processing were being designed to contain some of the most highly automated and remote systems conceived for a Department of Energy facility. Integrating safety, security, materials control and accountability (MC and A), and process systems at the proposed facilities would enhance the overall information and protection-in-depth available. Remote, automated fuel handling and assembly/disassembly techniques would deny access to the nuclear materials while upholding ALARA principles but would also require the full integration of all data/information systems. Such systems would greatly enhance MC and A as well as facilitate materials tracking. Physical protection systems would be connected with materials control features to cross check activities and help detect and resolve anomalies. This paper will discuss the results of a study of the safeguards and security benefits achieved from a highly automated and integrated remote nuclear facility and the impacts that such systems have on safeguards and computer and information security.

32590 (LA-UR–93-2568) **Neural information processing and self-organizing maps as a tool in safeguarding storage facilities.** Howell, J.A.; Fuyat, C. Los Alamos National Lab., NM (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930749–32: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93018554. Source: OSTI; NTIS; GPO Dep.

Storage facilities for nuclear materials and weapons dismantlement facilities could have a large number of sensors with the potential for generating large amounts of data. Because of the anticipated complexity and diversity of the data, efficient automatic algorithms are necessary to make interpretations and ensure secure and safe operation. New, advanced safeguards systems are needed to process the information gathered from monitors and make interpretations that are in the best interests of the facility or agency. In this paper we present a conceptual design for software to assist with processing these large quantities of data from storage facilities.

32591 (LA-UR–93-2580) **Development of a tomographic instrument for gamma-ray nondestructive assay.** Prettyman, T.H.; Estep, R.J.; Sheppard, G.A. Los Alamos National Lab., NM (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-931160–12: American Nuclear Society (ANS) winter meeting, San Francisco, CA (United States), 14-19 Nov 1993). Order Number DE93018551. Source: OSTI; NTIS; INIS; GPO Dep.

The most widely used Transmission-corrected gamma-ray nondestructive assay (NDA) instruments is the Segmented Gamma Scanner (SGS) that was developed by the Los Alamos Nuclear Safeguards program in the early 1970s to determine the radioisotopic content of waste. SGS assays are accurate for low-density samples and also for high-density samples that are known to be uniform and homogeneous. However, for dense, heterogeneous samples, substantial bias is observed in SGS assays. To assay heterogeneous samples, knowledge of the distribution of emitting and attenuating materials is required. As a result we are developing a tomographic instrument to assay samples for which the assumptions of the SGS analysis are grossly violated. This instrument, known as the Tomographic Gamma Scanner (TGS), has the same basic components as the SGS, including a HPGE detector, a transmission source, and a mechanism to rotate and elevate the sample. However, an additional mechanical motion has been added that allows the detector to move in the direction transverse to the sample axis. This additional motion in combination with more stringent detector collimation enables the TGS to acquire, three-dimensional transmission and emission tomographic projection data from which the distributions of emitting and attenuating material can be determined. This spatial information provides a detailed correction for sample heterogeneities that results in more accurate assays. Our work on the development of the TGS has emphasized the role of the TGS as an NA instrument. Accurate determination of the quantity of emitting material is the primary goal. Precise determination of the distribution of emitting materials is a secondary and potentially conflicting objective. Consequently, desip considerations and analysis techniques differ from those of computerized

tomography applied to medicine and nondestructive testing. An experimental TGS has been used to assay 208-ℓ drums containing plutonium.

32592 (LA-UR–93-2581) **Compliance or good control and accountability.** Erkkila, B.H. Los Alamos National Lab., NM (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930749–25: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93018550. Source: OSTI; NTIS; INIS; GPO Dep.

DOE Orders and draft orders for nuclear material control and accountability address the need for a complete material control and accountability (MC&A) program for all DOE contractors processing, using, and/or storing nuclear materials. These orders also address performance as well as compliance issues. Very often the existence of a program or an element of a program satisfies the compliance aspect of DOE requirements. The concept of performance requirements is new and requires new thinking with all of the elements of the MC&A program. The contractor is so accustomed to compliance with DOE requirements that dealing with performance is not well understood. In this paper I will address the receptiveness of performance requirements by the contractor. Auditing for performance is also a new concept and has not been implemented. The contractor will have to learn how to measure the performance of the MC&A program and be able to demonstrate a certain level of performance to the oversight organization. This paper will contain a discussion of a well organized MC&A program, the compliance issues associated with the program, the performance criteria associated with the program, and how to audit such a program.

32593 (LA-UR–93-2603) **Acoustic resonance spectroscopy in nuclear safeguards.** Olinger, C.T.; Lyon, M.J.; Stanbro, W.D.; Mullen, M.F.; Sinha, D.N. Los Alamos National Lab., NM (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930749–36: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93018543. Source: OSTI; NTIS; GPO Dep.

Objects resonate at specific frequencies when mechanically excited. The specific resonance frequencies are a function of shape, size, material of construction, and contents of the object. This paper discusses the use of acoustic resonance spectroscopy (ARS) to monitor containers and detect tampering. Evaluation of this technique is based on simulated storage simulations. Although these simulations show promise for this application of ARS, final evaluation will require actual field testing.

32594 (LA-UR–93-2610) **Thermal neutron multiplicity measurements using the pyrochemical multiplicity counter at Lawrence Livermore National Laboratory.** Langner, D.G. (Los Alamos National Lab., NM (United States)); Krick, M.S.; Parks, D.R.; Hooper, K.S. Los Alamos National Lab., NM (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930749–45: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93018538. Source: OSTI; NTIS; INIS; GPO Dep.

The pyrochemical multiplicity counter designed and built at Los Alamos has been undergoing tests and evaluation at Lawrence Livermore National Laboratory (LLNL). Measurements have been performed using a variety of plutonium oxide and metal materials. The pyrochemical multiplicity counter uses the information contained in the higher moments of the neutron multiplicity distribution to deduce the three unknowns in the assay problem: ^{240}Pu-effective mass, (α,n) neutron rate, and self-multiplication. This is an improvement over conventional neutron coincidence counting, which must rely on some estimate of the (α,n) neutron rate or self-multiplication to deduce an assay result. Such conventional techniques are generally unsatisfactory for impure materials for which these quantities are unknown. We present the assay results obtained with the pyro-chemical multiplicity counter and discuss the procedures necessary to produce good assay results. Using these procedures, we have obtained assay accuracies of 1%–2% for oxide materials in 1/2 hour measurement times. We also compare these results to those that would have been obtained using conventional neutron assay techniques and discuss the correlations we have observed between assay results and the ratio of total neutron counts in the different rings of the pyrochemical counter.

32595 (LA-UR–93-2639) **Seasonal variations in calorimeter baselines.** Sedlacek, W.A.; Cremers, T.L.; Camp, K.L.; Hildner, S.S. Los Alamos National Lab., NM (United States). 1993. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930749–28: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93018471. Source: OSTI; NTIS; INIS; GPO Dep.

Calorimetric assay, combined calorimeter measurement and gamma ray isotopic determination, can be the most precise and accurate non destructive assay method. However, for small quantities of nuclear material, the error in the calorimeter measurement can be quite large. The largest component of error for a calorimeter measurement of a low wattage item is often the error in the measurement of the baseline. The authors present baseline data going back several years for the production calorimeters at the Los Alamos Plutonium Facility. The baseline data show a remarkable seasonal variation that is present in several sizes and designs of calorimeter. The authors discuss the possible causes of this variation.

32596 (LA-UR–93-2667) **Investigations of the performance and nondestructive assay applications of the EMR/Schlumberger neutron generator.** Pickrell, M.M. (Los Alamos National Lab., NM (United States)); Mahdavi, M.; Pfutzner, H. Los Alamos National Lab., NM (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930749–35: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93018465. Source: OSTI; NTIS; GPO Dep.

Los Alamos and EMR/Schlumberger, are jointly investigating nondestructive assay applications using the EMR neutron generator system. This system is based on the instrument fielded by Schlumberger for oil well logging. This technology has been adapted into a complete system and package, which is intended for a variety of above-ground applications such as basic research, nuclear waste assay, activation analysis, and nuclear material analysis in both field and laboratory. The system has certain features, which have made it attractive for applications in the Los Alamos safeguards program. We will describe the neutron generator system and the over-all experimental equipment that will be used to explore some of these applications. We will also describe the general performance and some specific performance tests conducted at Los Alamos.

32597 (LA-UR–93-2668) **Development of high efficiency neutron detectors.** Pickrell, M.M.; Menlove, H.O. Los Alamos National Lab., NM (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930749–27: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93017954. Source: OSTI; NTIS; INIS; GPO Dep.

We have designed a novel neutron detector system using conventional ^{3}He detector tubes and composites of polyethylene, and graphite. At this time the design consists entirely of MCNP simulations of different detector configurations and materials. These detectors are applicable to low-level passive and active neutron assay systems such as the passive add-a-source and the ^{252}Cf shuffler. Monte Carlo simulations of these neutron detector designs achieved efficiencies of over 35% for assay chambers that can accommodate 55-gal. drums. Only slight increases in the number of detector tubes and helium pressure are required. The detectors also have reduced die-away times. Potential applications are coincident and multiplicity neutron counting for waste disposal and safeguards. We will present the general design philosophy, underlying physics, calculation mechanics, and results.

32598 (LA-UR–93-2669) **Analysis methods and performance of an automated system for measuring both**

concentration and enrichment of uranium in solutions. Kelley, T.A.; Parker, J.L.; Sampson, T.E. Los Alamos National Lab., NM (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930749–40: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93018464. Source: OSTI; NTIS; GPO Dep.

For the 1992 INNM Meeting, we reported on an automated system under development for measuring both concentration and enrichment of uranium in solutions. In this paper, we report on measurement methods, ysis algorithms, and performance of the delivered system. The uranium concentration is measured by a transmission-corrected x-ray fluorescence method. Cobalt-57 is the fluorescing source and a combined ^{153}Gd and ^{57}Co source is used for the transmission measurements. Corrections are made for both the absorption of the exciting ^{57}Co gamma rays and the excited uranium x-rays. The ^{235}U concentration is measured by a transmission-corrected method, which employs the 185.7-keV gamma ray of ^{235}U and a transmission source of ^{75}Se to make corrections for the self-absorption of the ^{235}U gamma rays in the solution samples. Both measurements employ high-resolution gamma-ray spectrometry and use the same 50-mℓ sample contained in a custom-molded, flat-bottomed, polypropylene bottle. Both measurements are intended for uranium solutions with concentrations $\geq$0.1 g U/ℓ although at higher enrichments the passive measurement will be even more sensitive.

32599 (LA-UR–93-3148) **Los Alamos waste drum shufflers users manual.** Rinard, P.M.; Adams, E.L.; Painter, J. Los Alamos National Lab., NM (United States). 24 Aug 1993. 119p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93019973. Source: OSTI; NTIS; INIS; GPO Dep.

This user manual describes the Los Alamos waste drum shufflers. The primary purpose of the instruments is to assay the mass of ^{235}U (or other fissile materials) in drums of assorted waste. It can perform passive assays for isotopes that spontaneously emit neutrons or active assays using the shuffler technique as described on this manual.

32600 (NUREG–0525-Vol.2-Rev.1) **Safeguards Summary Event List (SSEL): Volume 2, Revision 1, January 1, 1990–December 31, 1992.** Fadden, M.; Yardumian, J. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Fuel Cycle Safety and Safeguards. Jul 1993. 196p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

The Safeguards Summary Event List provides brief summaries of hundreds of safeguards-related events involving nuclear material or facilities regulated by the US Nuclear Regulatory Commission. Events are described under the categories: Bomb-related, Intrusion, Missing/Allegedly Stolen, Transportation-related, Tampering/Vandalism, Arson, Firearms-related, Radiological Sabotage, Nonradiological Sabotage, and Miscellaneous. Because of the public interest, the Miscellaneous category also includes events reported involving source material, byproduct material, and natural uranium, which are exempt from safeguards requirements. Information in the event descriptions was obtained from official NRC sources.

32601 (ORNL/FTR–4631) **Travel to Austria to participate in the quality control programs for uranium and plutonium measurements under ISPO Task D.66 for the Safeguards Analytical Laboratory: Foreign trip report, April 23–May 14, 1993.** Bayne, A.W. Oak Ridge National Lab., TN (United States). 7 Jun 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93015640. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report discusses a visit to the Safeguards Analytical Laboratory (SAL) was to evaluate the results of the statistical analysis to estimate detector efficiency factors for multidetector mass spectrometers, make a general review of quality-assurance/quality-control programs, and investigate the difference between isotopic measurements made by gamma spectrometry with those made by mass spectrometry.

32602 **Ceramic tamper-revealing seals.** Kupperman, D.S.; Raptis, A.C.; Sheen, Shuh-Haw. To Dept. of Energy. 1991. USA patent application 7-746,537. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93019332. Source: OSTI; NTIS; GPO Dep.

A tamper resistant seal is made of a brittle material with internal defects internally arranged in a random pattern to form a unique fingerprint characteristic of the seal which may be identified by ultrasonic scanning to determine whether tampering has occurred. It comprises a flexible metal or ceramic cable with composite ceramic ends or a U-shaped ceramic connecting element attached to a binding element plate or block cast from alumina or Zr, and connected to the connecting element by shrink fitting. Part of the binding element is cast with NiO_2 particles, which allows ultrasonic scanning and the resulting fingerprint. 7 figs.

32603 (PNL-SA–22129) **Detection of undeclared plutonium production (reactor operations/fuel reprocessing).** Perkins, R.W.; Wogman, N.A. Pacific Northwest Lab., Richland, WA (United States). Mar 1993. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9303158–2: International Atomic Energy Agency (IAEA) consultant's meeting, Vienna (Austria), 30 Mar - 2 apr 1993). Order Number DE93018873. Source: OSTI; NTIS; INIS; GPO Dep.

Plutonium (Pu-239) for nuclear weapons production can be produced in any nuclear reactor by irradiation of uranium (natural or enriched) where neutron capture occurs to form U-239, U-238(n,γ)U-239, which subsequently decays to produce Pu-239, U-239 $\rightarrow$ Np-239 $\rightarrow$ Pu-239. After a given irradiation time, plutonium can be extracted from the uranium fuel elements and used for nuclear weapons production. An alternate procedure for nuclear reactor production of fissile material is to irradiate thorium (Th-232) targets to produce U-233. This uranium isotope can also be subsequently extracted and serve as the fissile material for the production of nuclear weapons. Also tritium can be produced in a nuclear reactor for enhancing the yield of a nuclear weapon by irradiation of lithium, Li-6(n,α) ^{3}H. In the operation of nuclear reactor and subsequent fuel reprocessing, certain effluents are released to the environs which contain radionuclides indicative of these activities. The more readily observable and definable effluent signatures associated with these operations are discussed below.

32604 (PNL-SA–22130) **Current and potential technologies for the detection of radionuclide signatures of proliferation (R and D efforts).** Perkins, R.W.; Wogman, N.A. Pacific Northwest Lab., Richland, WA (United States). Mar 1993. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9303141–2: Department of Energy's (DOE) international safeguard meeting, Vienna (Austria), 22-23 Mar 1993). Order Number DE93018874. Source: OSTI; NTIS; INIS; GPO Dep.

A country with the goal of developing nuclear weapons could pursue their ambition in several ways. These could range from the purchase or theft of a weapon or of the principal weapons components to a basic development program which may independently produce all the materials and components which are necessary. If the latter approach were pursued, there would be many signatures of such an effort and the more definitive of these include the actual materials which would be produced in each phase of the fuel cycle/weapons production process. By identifying the more definitive signatures and employing appropriate environmental sampling and analysis techniques for their observation, including imaging procedures, it should be possible to detect nuclear proliferation processes. Possible proliferation processes include: uranium acquisition through fuel fabrication; uranium enrichment for weapons production; reactor operation for plutonium production; fuel reprocessing for plutonium extraction; weapons fabrication; and uranium 233 production. Each of these are briefly discussed. The technologies for the detection of proliferation signatures which are in concept or research and development phase are: whole air beta counter; radiokrypton/xenon separator/analyzer; I-129 detector; isotope analyzer; deuterium/tritium analysis by IR/Raman spectroscopy and scintillation counting; noble gas daughter analysis; and airborne radionuclide collector/analyzer.

32605 (SAND–93-0051) **A laboratory evaluation of color video monitors.** Terry, P.L. Sandia National Labs., Albuquerque,

NM (United States). Jul 1993. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93019772. Source: OSTI; NTIS; INIS; GPO Dep.

Sandia National Laboratories has considerable experience with monochrome video monitors used in alarm assessment video systems. Most of these systems, used for perimeter protection, were designed to classify rather than to identify intruders. There is a growing interest in the identification function of security video systems for both access control and insider protection. Because color video technology is rapidly changing and because color information is useful for identification purposes, Sandia National Laboratories established a program to evaluate the newest relevant color video equipment. This report documents the evaluation of an integral component, color monitors. It briefly discusses a critical parameter, dynamic range, details test procedures, and evaluates the results.

32606 (SAND–93-0445C) **Thermal imaging systems for Air Force security applications.** Herosian, G.E. (Vitro Corp., Hanscom AFB, MA (US). HQ USAF Electronic Systems Center); Pritchard, D.A. Sandia National Labs., Albuquerque, NM (United States). 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9306180–6: 9. annual joint Government-Industry symposium on security technology, Virginia Beach, VA (United States), 21-24 Jun 1993). Order Number DE93017495. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Thermal imagers have not been widely used in security applications. There has been an increased use in the last few years of existing military inventory and commercial imagers to satisfy a variety of security and surveillance needs. This paper provides an update on previously reported technology and discusses the recent history of applying today's available thermal imagers to security-related problems. It discusses the various applications and programs using, or planning to use, thermal imagers within the US Air Force, including tactical surveillance and assessment, and large-site assessment applications.

32607 (SAND–93-0470C) **Intelligent Facial Recognition Systems: Technology advancements for security applications.** Beer, C.L. Sandia National Labs., Albuquerque, NM (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9306180–3: 9. annual joint Government-Industry symposium on security technology, Virginia Beach, VA (United States), 21-24 Jun 1993). Order Number DE93017489. Source: OSTI; NTIS; GPO Dep.

Insider problems such as theft and sabotage can occur within the security and surveillance realm of operations when unauthorized people obtain access to sensitive areas. A possible solution to these problems is a means to identify individuals (not just credentials or badges) in a given sensitive area and provide full time personnel accountability. One approach desirable at Department of Energy facilities for access control and/or personnel identification is an Intelligent Facial Recognition System (IFRS) that is non-invasive to personnel. Automatic facial recognition does not require the active participation of the enrolled subjects, unlike most other biological measurement (biometric) systems (e.g., fingerprint, hand geometry, or eye retinal scan systems). It is this feature that makes an IFRS attractive for applications other than access control such as emergency evacuation verification, screening, and personnel tracking. This paper discusses current technology that shows promising results for DOE and other security applications. A survey of research and development in facial recognition identified several companies and universities that were interested and/or involved in the area. A few advanced prototype systems were also identified. Sandia National Laboratories is currently evaluating facial recognition systems that are in the advanced prototype stage. The initial application for the evaluation is access control in a controlled environment with a constant background and with cooperative subjects. Further evaluations will be conducted in a less controlled environment, which may include a cluttered background and subjects that are not looking towards the camera. The outcome of the evaluations will help identify areas of facial recognition systems that need further development and will help to determine the effectiveness of the current systems for security applications.

32608 (SAND–93-0771C) **Insider protection.** Waddoups, I.G. Sandia National Labs., Albuquerque, NM (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9306180–5: 9. annual joint Government-Industry symposium on security technology, Virginia Beach, VA (United States), 21-24 Jun 1993). Order Number DE93017648. Source: OSTI; NTIS; GPO Dep.

The government community is broadly addressing the insider threat. The first section of this paper defines protection approaches and the latter sections present various applicable technology developments. The bulk of the paper discusses technology developments applied to (1) personnel and material tracking and inventory, (2) classified document protection, and (3) protecting security systems. The personnel and material tracking system uses a PC based-host to (1) collect information from proximity tags and material movement sensors, (2) apply rules to this input to assure that the ongoing activity meets the site selectable rules and, (3) forward the results to either an automated inventory system or an alarm system. The document protection system uses a PC network to efficiently and securely control classified material which is stored on write-once-read-mostly optical media. The protection of sensor to multiplexer communications in a security system is emphasized in the discussion of protecting security systems.

32609 (SAND–93-1510C) **Vulnerability assessment using two complementary analysis tools.** Paulus, W.K. Sandia National Labs., Albuquerque, NM (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9306180–4: 9. annual joint Government-Industry symposium on security technology, Virginia Beach, VA (United States), 21-24 Jun 1993). Order Number DE93017650. Source: OSTI; NTIS; GPO Dep.

To analyze the vulnerability of nuclear materials to theft or sabotage, Department of Energy facilities have been using, since 1989, a computer program called ASSESS, Analytic System and Software for Evaluation of Safeguards and Security. During the past year Sandia National Laboratories has begun using an additional program, SEES, Security Exercise Evaluation Simulation, enhancing the picture of vulnerability beyond what either program achieves alone. Assess analyzes all possible paths of attack on a target and, assuming that an attack occurs, ranks them by the probability that a response force of adequate size can interrupt the attack before theft or sabotage is accomplished. A Neutralization module pits, collectively, a security force against the interrupted adversary force in a fire fight and calculates the probability that the adversaries are defeated. SEES examines a single scenario and simulates in detail the interactions among all combatants. its output includes shots fired between shooter and target, and the hits and kills. Whereas ASSESS gives breadth of analysis, expressed statistically and performed relatively quickly, SEES adds depth of detail, modeling tactical behavior. ASSESS finds scenarios that exploit the greatest weakness of a facility. SEES explores these scenarios to demonstrate in detail how various tactics to nullify the attack might work out. Without ASSESS to find the facility weakness, it is difficult to focus SEES objectively on scenarios worth analyzing. Without SEES to simulate the details of response vs. adversary interaction, it is not possible to test tactical assumptions and hypotheses. Using both programs together, vulnerability analyses achieve both breadth and depth.

32610 (SAND–93-1669C) **Python fiber optic seal.** Ystesund, K.; Bartberger, J.; Brusseau, C.; Fleming, P.; Insch, K.; Tolk, K. Sandia National Labs., Albuquerque, NM (United States). 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930749–50: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93018854. Source: OSTI; NTIS; GPO Dep.

Sandia National Laboratories has developed a high security fiber optic seal that incorporates tamper resistance features that are not available in commercial fiber optic seals. The Python Seal is a passive fiber optic loop seal designed to give indication of unauthorized entry. The seal includes a fingerprint feature that provides seal identity information in addition to the unique fiber optic pattern created when the seal is installed. The fiber optic cable used for

the seal loop is produced with tamper resistant features that increase the difficulty of attacking that component of a seal. A Seal Reader has been developed that will record the seal signature and the fingerprint feature of the seal. A Correlator software program then compares seal images to establish a match or mismatch. SNL is also developing a Polaroid reader to permit hard copies of the seal patterns to be obtained directly from the seal.

32611 (SAND–93-1678C) **Physical protection design approach for the Complex 21/Reconfiguration facilities.** Jaeger, C.D. (Sandia National Labs., Albuquerque, NM (US)); Zack, N.R.; Hunteman, W.J. Sandia National Labs., Albuquerque, NM (United States). 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789 ;W-7405-ENG-36. (LA-UR–93-2636;CONF-930749–13: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93017876. Source: OSTI; NTIS; GPO Dep.

Sandia National Laboratories and Los Alamos National Laboratory have been designated as the technical lead for Security, Safeguards and Computer/Information Security systems for all the DOE Complex 21/Weapons Complex Reconfiguration (WCR) facilities. The physical protection systems in these facilities will be required to meet the most current DOE orders and incorporate the latest physical protection technologies, proven state-of-the-art systems and strategies. The planned approach requires that security assistance and information be provided to the designers (e.g. the Complex 21 Architect & Engineer and the Weapons Complex Lead Laboratories) as early as possible and throughout all design phases. The outcome should avoid the costly retrofits to existing facilities that have occurred in the past and result in effective and comprehensive protection against current and projected threats with minimal impact on operations, safety and costs. This paper discusses the physical protection considerations being promoted for the integrated design effort for the Complex 21/Reconfiguration facilities, such as the tritium, uranium/lithium, plutonium processing and storage, high explosive and assembly and disassembly facilities.

32612 (SAND–93-1693C) **Sample Vial Secure Container.** Baumann, M.J. Sandia National Labs., Albuquerque, NM (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930749–23: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93017890. Source: OSTI; NTIS; GPO Dep.

International Atomic Energy Agency (IAEA) inspectors must maintain continuity of knowledge on all safeguard samples and, in particular, on those samples drawn from plutonium product and spent fuel input tanks at a nuclear reprocessing plant's blister sampling station. Integrity of safeguard samples must be guaranteed from the sampling point to the moment of sample analysis at an accepted local laboratory or at the IAEA's Safeguards Analytical Laboratory (SAL) in Seibersdorf, Austria. The safeguard samples are drawn at a blister sampling station with inspector participation and then transferred via a pneumatic post system to the facility's analytical laboratory. Transfer of the sample by the pneumatic post system, arrival of the sample in the operator's analytical laboratory, and storage of the sample awaiting analysis are very time consuming activities for an inspector, particularly if continuous human surveillance is required for all these activities. These activities could be observed by ordinary surveillance methods, such as a video monitoring system, but this would be cumbersome and time consuming for both the inspector and the operator. This paper describes a secure container designed to assure sample vial integrity from the point the sample is drawn to treatment of the sample at a facility's analytical laboratory.

32613 (SAND–93-1699C) **Vulnerability assessment using two complementary analysis tools.** Paulus, W.K. Sandia National Labs., Albuquerque, NM (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930749–22: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93017893. Source: OSTI; NTIS; GPO Dep.

To analyze the vulnerability of nuclear materials to theft or sabotage, Department of Energy facilities have been using, since 1989, a computer program called ASSESS, Analytic System and Software for Evaluation of Safeguards and Security. During the past year Sandia National Laboratories has began using an additional program, SEES, Security Exercise Evaluation Simulation, enhancing the picture of vulnerability beyond what either program achieves alone. ASSESS analyzes all possible paths of attack on a target and, assuming that an attack occurs, ranks them by the probability that a response force of adequate size can interrupt the attack before theft or sabotage is accomplished. A Neutralization module pits, collectively, a security force against the interrupted adversary force in a fire fight and calculates the probability that the adversaries are defeated. SEES examines a single scenario and simulates in detail the interactions among all combatants. Its output includes shots fired between shooter and target, and the hits and kills. Whereas ASSESS gives breadth of analysis, expressed statistically and performed relatively quickly, SEES adds depth of detail, modeling tactical behavior. ASSESS finds scenarios that exploit the greatest weaknesses of a facility. SEES explores these scenarios to demonstrate in detail how various tactics to nullify the attack might work out. Without ASSESS to find the facility weaknesses, it is difficult to focus SEES objectively on scenarios worth analyzing. Without SEES to simulate the details of response vs. adversary interaction, it is not possible to test tactical assumptions and hypotheses. Using both programs together, vulnerability analyses achieve both breadth and depth.

32614 (UCRL-JC–114597) **A database model for evaluating material accountability safeguards effectiveness against protracted theft.** Sicherman, A.; Fortney, D.S.; Patenaude, C.J. Lawrence Livermore National Lab., CA (United States). Jul 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930749–54: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93019150. Source: OSTI; NTIS; INIS; GPO Dep.

DOE Material Control and Accountability Order 5633.3A requires that facilities handling special nuclear material evaluate their effectiveness against protracted theft (repeated thefts of small quantities of material, typically occurring over an extended time frame, to accumulate a goal quantity). Because a protracted theft attempt can extend over time, material accountability-like (MA) safeguards may help detect a protracted theft attempt in progress. Inventory anomalies, and material not in its authorized location when requested for processing are examples of MA detection mechanisms. Crediting such detection in evaluations, however, requires taking into account potential insider subversion of MA safeguards. In this paper, the authors describe a database model for evaluating MA safeguards effectiveness against protracted theft that addresses potential subversion. The model includes a detailed yet practical structure for characterizing various types of MA activities, lists of potential insider MA defeat methods and access/authority related to MA activities, and an initial implementation of built-in MA detection probabilities. This database model, implemented in the new Protracted Insider module of ASSESS (Analytic System and Software for Evaluating Safeguards and Security), helps facilitate the systematic collection of relevant information about MA activity steps, and "standardize" MA safeguards evaluations.

32615 (WSRC-MS–93-073) **Accountability measurement precision and accuracy values: How good is good enough?.** Filpus-Luyckx, P.E. Westinghouse Savannah River Co., Aiken, SC (United States). 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-930749–7: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93016741. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy (DOE) Order 5633.3A requires that the desired levels of precision and accuracy be established for accountability measurements, that the magnitude of these uncertainties be minimized for major contributors to the limit of error for inventory differences (LEID), and that methods be selected, validated, and qualified that are capable of providing the desired levels. In an effort to consistently determine the desired precision

and accuracy levels for measurements within each of the nuclear material processing facilities at the Savannah River Site (SRS), a series of sensitivity studies were performed. To validate the current uncertainties as the goals, variance-propagated LEID models were used to determine the sensitivity of the LEID to each uncertainty value, using a nominal increase in the LEID as a figure-of-merit. These sensitivity studies provided the threshold values that each uncertainty needs to be held below. Engineering judgment and operational experiences were combined to qualitatively determine the need for improvement for each uncertainty. This paper describes the methodology of the sensitivity study, gives examples of the threshold values generated, and discusses the benefits of this approach in the approval process for proposed method changes.

0560 Legislation and Regulations

Refer also to citation(s) 32345, 32346, 32363, 32789, 32790, 32791, 32792, 32793, 32845

32616 (ORNL/M–1897) **Resource Conservation and Recovery Act. Environmental guidance program reference book: Revision 11.** Oak Ridge National Lab., TN (United States). 15 Mar 1992. 1293p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93007312. Source: OSTI; NTIS; GPO Dep.

This document describes the Resource Conservation and Recovery Act and implementing regulations.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

Refer also to citation(s) 33484

0701 Physical Isotope Separation

Refer also to citation(s) 32333, 32334

32617 (INIS-RU–347, pp. 403) **Radioactive sodium isotope separation by means of light-induced drift.** Ganginskij, Yu.P. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Gradechny, Ch.; Ermolaev, I.M.; Slovak, Ya.; Tetgal, T. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference*. 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. 1 ref. LASER ISOTOPE SEPARATION/sodium 22; LASER ISOTOPE SEPARATION/sodium 24; ISOTOPE RATIO; KRYPTON; LOW PRESSURE

32618 (UCRL-JC–110971) **Novel wave/ion beam interaction approach to isotope separation.** Post, R.F.; Lowder, R.S.; Schwager, L.A.; Barr, W.L.; Warner, B.E. Lawrence Livermore National Lab., CA (United States). Feb 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930159–53: OE/LASE '93: International Society for Optical Engineering (SPIE) conference, Los Angeles, CA (United States), 16-23 Jan 1993). Order Number DE93018084. Source: OSTI; NTIS; INIS; GPO Dep.

Numerical simulations and experimental studies have been made related to the possibility of employing an externally imposed electrostatic potential wave to separate isotopes. This wave/ion interaction is a sensitive function of the wave/ion difference velocity and for the appropriate wave amplitude and wave speed, a lighter faster isotope will be reflected by the wave to a higher energy while leaving heavier, slower isotopes virtually undisturbed in energy – allowing subsequent ion separation by simple energy discrimination. In these experiments, a set of some 200 individual, electrodes, which surrounded a microamp beam of neon ions, was used to generate the wave. Measurements of the wave amplitudes needed for ion reflection and measurements of the final energies of those reflected ions are consistent with values expected from simple kinetic arguments and with the more detailed results of numeric simulations.

0702 Radiation Sources

Refer also to citation(s) 33542, 33543, 34218, 34425

32619 (AECS-A/FRSR–66) **The effect of gamma irradiation on in vitro digestible energy of some agricultural residues.** Al-Masri, M.R. (Atomic Energy Commission, Damascus (Syrian Arab Republic). Dept. of Radiation Agriculture); Guenter, K.D. Atomic Energy Commission, Damascus (Syrian Arab Republic). Mar 1993. 31p. (In Arabic). Order Number DE94600231. Source: OSTI; NTIS (US Sales Only); INIS.

Experiments have been carried out on the effect of gamma irradiation on total energy, dry organic matter digestibility and on digestible energy of organic matter for some agricultural residues (maize straw, lentils straw, cottonwood, residues of apple-tree pruning, olive-cake first and second treatment). Sample were irradiated at 0, 50 and 100 KGy. Total energy was estimated by calorimeter. Digestibility was estimated in vitro by the method of Tilly and Terry (1963). Two sheep with rumen fistula were used as rumen liquor donating animals. Irradiation resulted in increasing the digestion of organic and dry matter and also the digestible energy of organic matter in all residues used except lentils straw and olive-cake first treatment. The increase in digestible energy values of organic matter (kJ) at dose of 100 KGy were: 155, 105, 71 and 25 for residue of apple-tree pruning, maize straw, cottonwood and olive-cake second treatment, respectively. (author).28 refs., 10 figs., 5 tabs.

32620 (ANL/IPNS/CP–79155) **Reference instrument complement for IPNS Upgrade.** Crawford, R.K. Argonne National Lab., IL (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9305177–8: 12. International collaboration of advanced neutron sources meeting (ICANS), Abingdon (United Kingdom), 24-28 May 1993). Order Number DE93017795. Source: OSTI; NTIS; INIS; GPO Dep.

A feasibility study for a new 1 MW pulsed neutron source has recently been completed at Argonne. As part of this feasibility study, an instrument package to instrument 24 of the 36 beam ports has been considered. This complement of instruments is outlined, and details of some of the instruments are discussed. Developments required before some of these instruments can be built are also indicated.

32621 (DOE/ER/60872–T2) **Thermal hydraulic design features for the BNCT application: Final report.** Blue, T.E.; Vafai, K. Ohio State Univ., Columbus, OH (United States). Dept. of Mechanical Engineering. Jun 1993. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-89ER60872. Order Number DE93017832. Source: OSTI; NTIS; GPO Dep.

This project report is based on our investigations for thermal design of a heat pipe for removing generated heat resulting from Proton bombardments of a Lithium target for a BNCT application. In our investigation, an integral analysis was employed to investigate the vapor an liquid flow in a flat plate heat pipe heated asymmetrically for removal of the 75 kW generated from the BNCT application. The flat plate heat pipe configuration will be used for removing the heat which is generated as a result of proton bombardment of the lithium target. The working fluid in the heat pipe occurs in two phase namely liquid and vapor. The wick contains all the liquid phase and the vapor phase is mainly in the core region. Heat is applied by an external source at the evaporator section which vaporizes the working fluid in this section. This results in a pressure difference which drives the vapor to the condenser section where condenses and releases latent heat of vaporization to a heat sink in the condense section. Due to the vaporization of liquid in the evaporator, the liquid-vapor interface enters into the wick surface and hence capillary pressure is developed there. This capiliary pressure causes the condensed liquid in the condenser to be pumped back to the evaporator again. The results of our investigation have enabled us to correlate such diverse information as; the

thickness of the wick, the diameter of the heat pipe, the wetting angle, the capillary radius, the surface tension, the latent heat of evaporation, the permeability and porosity of the chosen wick, the length of the heat pipe, and the viscosity and density of the two phases; with the heat removal capabilities of the heat pipe. Expressions for the pressure and velocity distributions are obtained and discussed in relation to our application to BNCT. The present design clearly shows that it is possible to attain temperatures well below the melting temperature of the lithium in the BNCT application.

32622 (DOE/FTR–93014404) **Travel to the Netherlands to perform neutron and gamma field measurements at the High Flux Reactor: Foreign trip report, April 19–23, 1993.** Harker, Y.D.; Amaro, C.R. EG and G Idaho, Inc., Idaho Falls, ID (United States). 26 May 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93014404. Source: OSTI; NTIS (US Sales Only); GPO Dep.

During the period of April 17–24, 1993, we visited the Commission of European States Petten Laboratory and the Netherlands Energy Research Foundation (ECN) Laboratory located next to each other at Petten, North Holland, The Netherlands. The purpose of our visit was to perform neutron and gamma field measurements on the European Commission's Epithermal Neutron Beam on the HB-11 Beam Port of the High Flux Reactor (HFR). These measurements were done in support of the INEL Boron Neutron Capture Therapy (BNCT) large animal model irradiation program conducted in cooperation with the European Commission's BNCT program at the HB-11 beam facility. In 1991, we made a similar visit to this laboratory for the same purpose; however since those measurements, the heat exchanger to the HB-11 liquid-argon neutron filter has been upgraded and its performance has been greatly improved in terms of reducing the gamma and fast neutron contamination in the resulting epithermal neutron beam. Since the majority of the large animal irradiation studies were performed after the filter modification, it was necessary for us to repeat the earlier measurements so that we may have closure on interpreting the dose effects from the irradiations performed after the filter modification.

32623 (INIS-RU–347, pp. 409) **High-energy gamma radiation source.** Voronkov, E.I.; Danilenko, V.P.; Krot, N.N.; Stepanov, Eh.K.; Terminov, V.P.; Fedoseev, A.M. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. GAMMA SOURCES/mev range 01-10; ALPHA REACTIONS; CALIBRATION; CARBON 13 TARGET; ERRORS; GAMMA RADIATION; OXYGEN 16

32624 (INIS-RU–347, pp. 430) **Standard isotopic x-radiation sources (SIXRS).** Karmalitsyn, N.I.; Sazonova, T.E.; Sehpman, S.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. GAMMA SOURCES/calibration standards; X-RAY SOURCES/calibration standards; AMERICIUM 241; CADMIUM 109; COBALT 57; ERRORS; GAMMA RADIATION; IRON 55; KEV RANGE 01-10; KEV RANGE 10-100; STRONTIUM 85; VANADIUM 49; X RADIATION; YTTRIUM 88

32625 (INIS-RU–347, pp. 432) **Measurement of characteristics of the precise spectrometric americium-241 alpha source.** Frolov, E.A.; Larichev, A.A.; Karmalitsyn, N.I.; Khavelka, M.; Dryyak, P.; Kovarzh, P.; Vasha, R. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. ALPHA SOURCES/americium 241; ALPHA SOURCES/spectral shift; ALPHA DECAY; ELECTRODEPOSITION; LEVEL WIDTHS

32626 (INIS-RU–347, pp. 435) **Possibilities of application of the backscattering method for control of the integral circuit technological layers.** Dobrolezh, S.A. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Polyanskij, V.N.; Tokarevskij, V.V.; Chesnokova, T.D.; Shcherbin, V.N. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. COATINGS/quality control; ALPHA PARTICLES; ALUMINIUM; BACKSCATTERING; COATINGS; ENERGY SPECTRA; INTEGRATED CIRCUITS; INTERFACES; MEV RANGE 01-10; SEMICONDUCTOR DEVICES; SILICON; SUBSTRATES; THIN FILMS

32627 (JAERI-M–93-042) **A microbiological study on irradiated sludge composting.** Pongpat, S. (Office of Atomic Energy for Peace, Bangkok (Thailand)); Hashimoto, Shoji. Japan Atomic Energy Research Inst., Tokyo (Japan). Mar 1993. 22p. Order Number DE93520240. Source: OSTI; NTIS; INIS.

Effect of fermentation temperature on microorganisms in sewage sludge compost and suppressive effect of the compost on Fusarium oxysporum were investigated. Dehydrated sewage sludge was irradiated at 10 kGy by cobalt 60 gamma ray source and fermented at various temperatures with six different seed-composts. It was found that microorganisms showed higher growth in irradiated sludge at the temperature around 30 to 40degC. One of the seed-composts and compost produced from the seed-compost showed the remarkable effects of suppression on F. oxysporum. It can be also observed that the composts produced by lower temperature fermentation showed higher suppression. (author).

32628 (UCRL-JC–114922) **X-ray plasma source design simulations.** Cerjan, C. Lawrence Livermore National Lab., CA (United States). Jul 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9305159–3: Optical Society of America (OSA) topical meeting on soft x-ray projection lithography, Monterey, CA (United States), 10-12 May 1993). Order Number DE93018631. Source: OSTI; NTIS; GPO Dep.

The optimization of soft x-ray production from a laser-produced plasma for lithographic applications is discussed in the context of recent experiments by R. Kauffman et al. which indicate that a conversion efficiency of 0.01 can be obtained with Sn targets at modest laser intensity. Computer simulations of the experiments delineate the critical phenomena underlying these high conversion efficiencies, especially the role of hydrodynamic expansion and radiative emission. Qualitative features of the experiments are reproduced including the transition from one-dimensional to two-dimensional flow. The quantitative discrepancy is ascribed to incorrect initiation of the ablating plasma and to inadequate atomic transition rate evaluation.

32629 (WSRC-TR–93-299) **Ultrasonic technique for inspection of GPHS capsule girth weld integrity.** Placr, Arnost. Westinghouse Savannah River Co., Aiken, SC (United States). May 1993. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93040072. Source: OSTI; NTIS; INIS; GPO Dep.

An innovative nondestructive examination (NDE) technique for the inspection of integrity of General Purpose Heat Source (GPHS) capsule girth welds (Figure 1) was developed employing a Lamb

(plate) wave as the mode of the sound propagation. Reliability of the Lamb wave technique was tested on GPHS capsules using plutonium pallet simulators. All ten capsules, which were previously rejected, passed ultrasonic (UT) inspection using the Lamb wave technique.

0703 Isotopic Power Supplies

32630 (LA–12588-PR) **Heat source technology program: Quarterly report, October–December 1992.** George, T.G. (comp.). Los Alamos National Lab., NM (United States). Jul 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93017619. Source: OSTI; NTIS; GPO Dep.

This quarterly report describes activities performed in support of Cassini fueled-clad production and studies related to the use of $^{238}PuO_2$ in radioisotope power systems carried out for the Office of Special Applications of the US Department of Energy (DOE) by Los Alamos National Laboratory (LANL). Most of the activities described are ongoing; the results and conclusions described may change as the work progresses.

32631 (LA–12638-PR) **Heat Source Technology Program monthly progress report, June 1993.** George, T.G. (comp.). Los Alamos National Lab., NM (United States). Sep 1993. 8p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93019394. Source: OSTI; NTIS; GPO Dep.

This monthly report describes activities performed in support of Cassini fueled-clad production and studies related to the use of $^{238}PuO_2$ in radioisotope power systems carried out for the Office of Special Applications of the US Department of Energy (DOE) by Los Alamos National Laboratory (LANL). Most of the activities described are ongoing; the results and conclusions described may change as the work progresses.

08 HYDROGEN

32632 (DOE/EE–0399) **Hydrogen Energy Coordinating Committee annual report: Summary of DOE hydrogen programs for FY 1991–1992.** USDOE Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC (United States). Office of Energy Management. May 1993. 58p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93019186. Source: OSTI; NTIS; GPO Dep.

The Hydrogen Energy Coordinating Committee (HECC) was established over 14 years ago to ensure that the many varied aspects of hydrogen technology research and development within the Department are coordinated. Each year the committee brings together technical representatives within the Department to coordinate activities, share research results and discuss future priorities and directions. An annual report is published summarizing the work in progress. This summary is the fourteenth consecutive report. It provides an overview of the hydrogen-related programs of the DOE offices represented in the HECC.

0801 Production

Refer also to citation(s) 32288

32633 (LA-UR–93-2355) **Preferential oxidation of methanol and carbon monoxide for gas cleanup during methanol fuel processing.** Birdsell, S.A. (Los Alamos National Lab., NM (United States)); Vanderborgh, N.E.; Inbody, M.A. Los Alamos National Lab., NM (United States); General Motors Corp., Indianapolis, IN (United States). Allison Gas Turbine Div. [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36 ;AC02-90CH10435. (CONF-930804–10: 28. intersociety energy conversion engineering conference, Atlanta, GA (United States), 8-13 Aug 1993). Order Number DE93016489. Source: OSTI; NTIS; GPO Dep.

Methanol fuel processing generates hydrogen for low-temperature, PEM fuel cell systems now being considered for transportation and other applications. Although liquid methanol fuel is convenient for this application, existing fuel processing techniques generate contaminants that degrade fuel cell performance. Through mathematical models and laboratory experiments chemical processing is described that removes CO and other contaminants from the anode feed stream.

0802 Storage, Transport, and Handling

32634 (DOE/FTR–93014685) **Travel to Sweden to present talk on the electronic structure of alkali metal-nickel group hydrogen compounds: Foreign trip report, June 6–July 10, 1992.** Switendick, A.C. Sandia National Labs., Albuquerque, NM (United States). 19 Aug 1992. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93014685. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The symposium is the latest in a series of biannual meetings held on this topic dating back to 1972. Topics of interest include metal hydrides for hydrogen storage, heat pumps and fuel cells. A topic of new interest is the nickel-metal hydride battery which is being produced in Japan at the rate of 3,000,000 per month. The major advantage of these cells is their lack of environmentally dangerous materials found in other cells (mercury, cadmium, etc). In Paris, I worked with Prof. Michele Gupta and her husband Dr. Raju Cupta of the Nuclear Research Center in Saclay. We collaborated on an interchange of computer programs and the implementation of new programs. I also visited the Hahn-Meitner Institute in Berlin at the invitation of Dr. Peter Vorderwisch and the Laboratory of Chemical Physics at the University of Pierre and Marie Curie in Paris at the invitation of Prof. Esther Belin.

0820 Legislation and Regulations

Refer also to citation(s) 33041

0830 Combustion

Refer also to citation(s) 32943

09 BIOMASS FUELS

32635 (ADEME–91-01-DOC-1) **Biomass: an energy source for the quality of environment.** Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. 245p. (In French). (CONF-9111328–: Colloquium on biomass: an energy source for the quality of environment, Paris (France), 27-28 Nov 1991). Order Number DE94700004. Source: OSTI; NTIS (US Sales Only).

The various themes of the conference are: utilization of fuels from biomass in order to reduce the emission of greenhouse effect gases (carbon cycle, energy balance of bio-fuels, wood combustion, economical incentives); biomass fuel utilization in order to reduce urban area air pollution from automobiles; wood combustion regulations and pollution abatement; the problem of biomass cultivation without production of nitrate excess; agriculture, land management and organization, environmental effects for biomass production.

32636 (ADEME–91-01-DOC-1, pp. 33-35) **Energy balance of biofuels.** Poitrat, E. (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France)). Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9111328–: Colloquium on biomass: an energy source for the quality of environment, Paris (France), 27-28 Nov 1991). In *Biomass: an energy source for the quality of environment.* 245p. Order Number DE94700004. Source: OSTI; NTIS (US Sales Only).

Energy balances of fuels from biomass (conversion efficiency and substitution capacity) are shown to be always greater than 1 whereas oil product energy balance is always inferior to 1 because a part of the extracted energy is used to obtain refined products. Biofuels appear energetically more efficient than oil products for they are renewable energies and the photosynthesis efficiency is good.

32637 (ADEME–91-01-DOC-1, pp. 37-54) **Bio-fuels and greenhouse effect gas.** Desmarquest, J.P. (Institut Francais du

Petrole (IFP), 92 - Rueil-Malmaison (France)). Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9111328--: Colloquium on biomass: an energy source for the quality of environment, Paris (France), 27-28 Nov 1991). In *Biomass: an energy source for the quality of environment.* 245p. Order Number DE94700004. Source: OSTI; NTIS (US Sales Only).

Production and utilization of fossil or biomass fuels induce greenhouse effect through emissions of carbon dioxide, water vapour and other gases; gaseous emissions from engine/conventional fuel systems are calculated, and the effect of addition of biomass derived oxygenous compounds on the type and quantity of emitted gas is studied. Emissions produced through the entire production, raw material transportation and fuel processing system, are taken into account. At the utilization level, the carbon dioxide emitted during combustion of bio-fuels is considered as completely recycled. Reduction of CO2 emissions through biofuel utilization may be important provided that the energy used for biomass conversion is issued from a renewable substrate or from nuclear energy electricity.

0907 Resources

Refer also to citation(s) 32659, 32663, 33100

32638 (ADEME--91-01-DOC-1, pp. 213-234) **Agricultural raw material supply simulation with the aim of bio-fuel production.** Sourie, J.C. (Institut National de Recherches Agronomiques (INRA), 75 - Paris (France)); Hautcolas, J.C.; Blanchet, J. Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9111328--: Colloquium on biomass: an energy source for the quality of environment, Paris (France), 27-28 Nov 1991). In *Biomass: an energy source for the quality of environment.* 245p. Order Number DE94700004. Source: OSTI; NTIS (US Sales Only).

Simulations concerning biomass supply for bio-fuel production have been developed, based on a regional model integrating up to 400 elementary models of farm production. Production condition variety among farms is thus represented and alternatives between food, non-food and fallow agricultural areas are taken into account. The simulation allows a more precise evaluation of the potentially supplied volumes, an optimization of the non-food agricultural cultivations in the farm system and an evaluation of the effects on the agricultural benefits in a region.

0908 Production

Refer also to citation(s) 32658

32639 (DOE/EA--0849) **Biomass Gasifier Facility (BGF): Environmental Assessment.** Pacific International Center for High Technology Research, Honolulu, HI (United States); Hawaii Natural Energy Inst., Honolulu, HI (United States); Institute of Gas Technology, Chicago, IL (United States); Parsons (Ralph M.) Co., Pasadena, CA (United States). Sep 1992. 93p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93019112. Source: OSTI; NTIS; GPO Dep.

The Pacific International Center for High Technology Research (PICHTR) is planning, to design, construct and operate a Biomass Gasifier Facility (BGF). This facility will be located on a site easement near the Hawaiian Commercial & Sugar company (KC&S) Paia Sugar Factory on Maui, Hawaii. The proposed BGF Project is a scale-up facility, intended to demonstrate the technical and economic feasibility of emerging biomass gasification technology for commercialization. This Executive Summary summarizes the uses of this Environmental Assessment, the purpose and need for the project, project.description, and project alternatives.

32640 (DOE/ER--93017838) **Summary report of a workshop on research opportunities in plant biochemistry, December 11--13, 1992, Kona, Hawaii.** USDOE Office of Energy Research, Washington, DC (United States). Energy Biosciences Div. [1992]. 29p. Sponsored by USDOE, Washington, DC (United States). (CONF-921289--Summ.: Workshop on research opportunities in plant biochemistry, Kona, HI (United States), 11-13 Dec 1992). Order Number DE93017838. Source: OSTI; NTIS; GPO Dep.

A DOE-sponsored workshop was held December 11--13, 1992 in Kona, Hawaii to discuss those aspects of fundamental research in plant biochemistry deemed essential to provide the basic information base necessary for exploiting plant biotechnology to meet future societal needs. Twenty nine scientists, with interests representing many of the various areas of plant biochemistry, participated. The workshop was intended to define in both broad and specific terms the current state of knowledge in the general area of metabolic biochemistry, and to identify those areas that afford unusual opportunity or that are relatively underdeveloped in comparison with other areas of plant biology. Participants provided critiques of the state of knowledge of the major areas of metabolic biochemistry in relation to a series of questions that are presented herein.

0909 Processing

Refer also to citation(s) 32765, 33106, 33111, 33113, 33295

32641 (DOE/FTR--93016756) **Travel to Finland for the International Energy Agency Symposium on Biotechnology for the Conversion of Lignocellulose: Foreign trip report, June 7--9, 1993.** Wyman, C. National Renewable Energy Lab., Golden, CO (United States). 6 Jul 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE93016756. Source: OSTI; NTIS (US Sales Only); GPO Dep.

On June 7--9, 1993, I attended the international Energy Agency Symposium on Biotechnology for the Conversion of Lignocellulose in Helsinki, Finland. 120 people representing 24 countries had registered to attend the Symposium. An extensive session devoted to enzymology of lignocellulose conversion followed introductory remarks, an overview presentation, and two plenary talks. Also included in the program were sessions on pretreatment and hydrolysis, enzymatic treatment of pulp, round robin evaluations, fermentation, and modeling and technoeconomic analysis. Overall, the meeting brought together leading experts from around the world on each topic, and it was particularly revealing to observe the extensive effort by other countries in xylanase development as well as the diverse economic projections by various groups. This symposium was very valuable in giving a better perspective on international activities in the field and insuring the United States remains current in critical technology areas.

32642 (ETSU-B/FW--00239/REP) **Anaerobic digestion in the UK: A review of current practice.** Baldwin, D.J. Agricultural Development and Advisory Service (ADAS), Silsoe (United Kingdom). 1993. 76p. Order Number DE93516761. Source: OSTI; NTIS (US Sales Only).

The overall objective in this study was to review the success of anaerobic digesters on farms, and to identify the criteria for purchase and provide information on the current demand for digesters, taking into account opportunities for environmental protection and power generation. Specific objectives were to establish an up-to-date UK data bank of agricultural digesters, and to up-date the data bank for the remainder of Europe; to compile an In Confidence list of farming companies known to have shown interest at sometime in investing in a digester; to carry out studies of selected farm businesses in Europe which have interests in anaerobic digesters; and to review the trials of recent farm digester test cases in the UK and to examine the conclusions in order to establish the level of incentive and confidence that these impart to farmers considering uptake of the technique. (author)

32643 (ETSU-B/MS--00192/20/REP) **The treatment, reprocessing and incineration of animal waste slurries and sewage sludges: An evaluation of the state-of-the-art in the Netherlands and Japan.** Kamp, W.L. van de; Smart, J.P. International Flame Research Foundation, Ijmuiden (Netherlands). 1993. 52p. Contract E/5A/1329/2609/20. (IFRF-Doc-G--20/y/3). Order Number DE93516762. Source: OSTI; NTIS (US Sales Only).

The primary objective of this study was to determine the state-of-the-art with respect to conversion, treatment and reprocessing of

animal waste slurries in Europe (concentrating on the Netherlands) and Japan. A further objective of the study was to produce preliminary information on processes used in the treatment of human wastes as found in municipal sewage sludge in these countries. (author)

0910 Properties and Composition

Refer also to citation(s) 32636

0920 Combustion

Refer also to citation(s) 32643, 32672

32644 (ADEME–91-01-DOC-1, pp. 55-78) **Wood combustion and greenhouse effect gas: comparison with conventional fuels.** Cabot, G. (Centre Technique des Industries Aerauliques et Thermiques (CETIAT), 75 - Paris (France)). Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9111328–: Colloquium on biomass: an energy source for the quality of environment, Paris (France), 27-28 Nov 1991). In *Biomass: an energy source for the quality of environment.* 245p. Order Number DE94700004. Source: OSTI; NTIS (US Sales Only).

The two main wood boiler types are the conventional open-flue boilers and the turbo-type boilers with fan and inverse combustion; their energy efficiency and greenhouse effect gas emissivity are characterized and compared to conventional fuel and natural gas boilers. The effects of wood type (hornbeam and pine) and humidity level on these characteristics are also examined.

32645 (ADEME–91-01-DOC-1, pp. 123-134) **Wood combustion: air pollution emission regulations and diminution techniques.** Fontelle, J.P. Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9111328–: Colloquium on biomass: an energy source for the quality of environment, Paris (France), 27-28 Nov 1991). In *Biomass: an energy source for the quality of environment.* 245p. Order Number DE94700004. Source: OSTI; NTIS (US Sales Only).

Regulations concerning wood burning appliances in several countries are examined; dusts are generally covered by regulations, but NOx, CO, hydrocarbons are not always taken into account. Limitation values are compared in the different countries as a function of various parameters such as plant output, age and site of implantation, utilization conditions, wood type, burning appliance type, etc. Comparisons are difficult as reference conditions in the various countries are different. Application sectors and dust separator technique costs are discussed.

32646 (ADEME–91-01-DOC-2) **New data on the use of energy from wood.** Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. 489p. (In French). (CONF-9110513–: Colloquium on new data on the use of energy from wood, Paris (France), 15-16 Oct 1991). Order Number DE94700005. Source: OSTI; NTIS (US Sales Only).

Status and prospects for energy from wood (wood fuel consumption, wood burning appliance market) in France are first presented. The themes of the four sessions are concerning: individual space heating with wood fuel (energy efficiency, combustion control, market analysis, marketing), central space heating with wood logs and platelets (furnaces, service life, corrosion problems, pollution emissions, combustion control), automatic wood burning appliances and wood fuel plants (fuel supply and demand, equipment, opportunities), standards and strategy for energy-from-wood widening.

32647 (ADEME–91-01-DOC-2, pp. 16-23) **New values concerning wood fuel consumption in residential sector.** Savanne, D. (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France)); Dufour, N.; Degand, C. Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9110513–: Colloquium on new data on the use of energy from wood, Paris (France), 15-16 Oct 1991). In *New data on the use of energy from wood.* 489p. Order Number DE94700005. Source: OSTI; NTIS (US Sales Only).

Half of the french households are using wood for space heating (as principal or secondary energy source), frequently associated to electric heating. Wood fuel consumption in residential sector is equivalent to electricity or gas consumption. Statistics concerning wood consumption are given, with respect to near-by forest surface, users' socio-professional category, and primary energy type.

32648 (ADEME–91-01-DOC-2, pp. 26-28) **Evolution of the french wood burning appliance market and volume.** Savanne, D. (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France)). Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9110513–: Colloquium on new data on the use of energy from wood, Paris (France), 15-16 Oct 1991). In *New data on the use of energy from wood.* 489p. Order Number DE94700005. Source: OSTI; NTIS (US Sales Only).

A market survey concerning wood burning appliances for residential space heating in France is presented; results are compared from 1984 to 1988: wood central heating systems are decreasing (half of them are cookers) while single wood burning appliances are strongly increasing due to the fast increase of insert-type amount.

32649 (ADEME–91-01-DOC-2, pp. 67-86) **A guide-book for an appropriate fire control.** Cassin, P. (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France)); Launey, M.; Lepretre, G.; Remondiere, M. Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9110513–: Colloquium on new data on the use of energy from wood, Paris (France), 15-16 Oct 1991). In *New data on the use of energy from wood.* 489p. Order Number DE94700005. Source: OSTI; NTIS (US Sales Only).

Tests have been performed in order to evaluate closed-type wood burning appliance performance with respect to various parameters such as fuel charge mass, wood type, wood log dimensions, combustion air flow rate and system, wood water content and charging rate. Performance rates are appliance energy efficiency and power. The test bench is described.

32650 (ADEME–91-01-DOC-2, pp. 87-101) **The closed wood burning appliance for individual rental dwellings.** Tegon, C. Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9110513–: Colloquium on new data on the use of energy from wood, Paris (France), 15-16 Oct 1991). In *New data on the use of energy from wood.* 489p. Order Number DE94700005. Source: OSTI; NTIS (US Sales Only).

The concept of wood central heating with duct network for council buildings and very low income populations, is examined as an alternative to electric space heating. A pilot heating system has been installed and its main characteristics are presented: venturi effect transverse heat exchanger, thermostatic control, automatic draft control, filtration system, etc. Economics, council building regulations and investment aspects are reviewed.

32651 (ADEME–91-01-DOC-2, pp. 106-114) **Advances in wood log burning appliances for space heating.** Cassin, P. (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France)). Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9110513–: Colloquium on new data on the use of energy from wood, Paris (France), 15-16 Oct 1991). In *New data on the use of energy from wood.* 489p. Order Number DE94700005. Source: OSTI; NTIS (US Sales Only).

Traditional upward, horizontal and inverse natural vent combustion appliances are gradually replaced by better performing turbo-type burners. Design principles, characteristics and performances of turbo-type burners are presented. Problems of equipment degradation and durability and of greenhouse effect gas emissions are assessed and remedies are proposed. Greenhouse effect gas emissions from the various types of log burners are evaluated and quantified.

32652 (ADEME–91-01-DOC-2, pp. 116-123) **Standardization and regulations: state of the art in France and in Europe.** Care, I. (Centre Technique des Industries Aerauliques et Thermiques, 69 - Villeurbanne (France)). Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9110513–: Colloquium on new data on the use of energy from wood, Paris (France), 15-16 Oct 1991). In *New data on the*

use of energy from wood. 489p. Order Number DE94700005. Source: OSTI; NTIS (US Sales Only).

A review of the standards concerning solid, liquid or gas fuel burners and wood burning appliances, in various european countries (Austria, Germany, Belgium, Spain, France, Greece, Ireland, Netherlands, Denmark, Italy, Portugal, Sweden and Switzerland) is presented: operating conditions, thermal conditions (efficiency, water and fume temperatures), engineering requirements, pollutant emissions, testing procedures, certification, mark and information.

32653 (ADEME–91-01-DOC-2, pp. 125-151) **Furnace service life: a matter of professionalism and training. Accelerated ageing and off-standard tests.** Bourbon, R. (Centre Technique des Industries Aerauliques et Thermiques, 69 - Villeurbanne (France)). Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9110513–: Colloquium on new data on the use of energy from wood, Paris (France), 15-16 Oct 1991). In *New data on the use of energy from wood.* 489p. Order Number DE94700005. Source: OSTI; NTIS (US Sales Only).

Results from tests realized on wood burning appliances with respect to combustion mode (combustion efficiency, fume temperature, useful effect), shift from reference conditions (throughput, wood water content, water temperature, log dimension, depression at the nozzle) and effect on service life and durability of forced draft inverse combustion burners.

32654 (ADEME–91-01-DOC-2, pp. 153-174) **Furnace service life: a matter of professionalism and training. Wood combustion generates acids.** Mezerette, C. Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9110513–: Colloquium on new data on the use of energy from wood, Paris (France), 15-16 Oct 1991). In *New data on the use of energy from wood.* 489p. Order Number DE94700005. Source: OSTI; NTIS (US Sales Only).

Corrosion problems (such as chamber perforation) have been encountered in turbo-type wood furnaces, due to organic acids contained in flue gas. Effects of various parameters involving raw material (wood species, water content, log diameter, ...) or operating conditions (process throughput, back-flow water temperature, depression at the nozzle, ...), on combustion gases quality, are examined. It is shown that the three studied species (hornbeam, oak and pine) do not generate same acid quantities and that operating throughput has a strong effect on acid concentration in flue gas.

32655 (ADEME–91-01-DOC-2, pp. 176-196) **Manual feed wood log furnaces; specifications for design and operation. State of the art in Europe.** Druette, L. Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9110513–: Colloquium on new data on the use of energy from wood, Paris (France), 15-16 Oct 1991). In *New data on the use of energy from wood.* 489p. Order Number DE94700005. Source: OSTI; NTIS (US Sales Only).

In order to avoid accelerated corrosion problems in wood log burning appliances, some minimal rules concerning design of the furnace have to be applied: a correct dimensioning of the furnace, a hydraulic network designed to maintain the combustion chamber at the adequate temperature and ensure operational safety, and adequate coupling of the furnace to a flue duct in order to ensure flue gas exhaust whatever the operating conditions. A review of the main rules and experience in France (four-way slide valve and return pump (non sufficient against acidity)), Switzerland (over-dimensioning), Germany and Sweden (coupling with an hydro-accumulator).

32656 (ADEME–91-01-DOC-2, pp. 203-209) **High-performance utilization of energy from wood in Sweden.** Lovgren, B.E. Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9110513–: Colloquium on new data on the use of energy from wood, Paris (France), 15-16 Oct 1991). In *New data on the use of energy from wood.* 489p. Order Number DE94700005. Source: OSTI; NTIS (US Sales Only).

In order to satisfy environmental and comfort requirements, heating with energy from wood must be realized with high temperature combustion and steady throughput during combustion. Hydro-accumulation is an important mean for an optimal combustion and reduced emissions: effects of wood parameters such as wood quality and humidity are reduced together with gaseous emissions. The energy output is increased twofold. Importance of high temperature combustion combined to hydro-accumulation and ceramic heating zones in the furnace are shown.

32657 (ADEME–91-01-DOC-2, pp. 250-268) **Energy from wood, an eco-system.** Chartier, P. (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France)); Cassin, P. Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9110513–: Colloquium on new data on the use of energy from wood, Paris (France), 15-16 Oct 1991). In *New data on the use of energy from wood.* 489p. Order Number DE94700005. Source: OSTI; NTIS (US Sales Only).

An evaluation method for the effect of energy use on environment is presented, considering collection, waste quantities, water and air pollution, noise, energy consumption, and natural source consumption in the various stages of production, distribution, utilization and disposal. Wood from energy is evaluated through this methodology; ecological standards are analyzed for their effect on energy-from-wood wide-spreading. Standards for wood combustion in the various european countries and greenhouse effect gaseous emission are discussed with the aim to enhance energy from wood optimization and utilization.

32658 (ADEME–91-01-DOC-2, pp. 269-279) **Fuel deposits and supplying.** Dacosta, Y. Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9110513–: Colloquium on new data on the use of energy from wood, Paris (France), 15-16 Oct 1991). In *New data on the use of energy from wood.* 489p. Order Number DE94700005. Source: OSTI; NTIS (US Sales Only).

A market research concerning wood fuel supply to collective or industrial boiler plant and heating systems in France is presented. Prices (at the boiler plant), quantity, quality, thermal equivalent and mode of utilization of the various wood fuels are detailed: forest small wood platelets, sawmill waste platelets, uncrushed small wastes, sawdust, granulates from sawdust, de-ironed wood refuse crushings.

32659 (ADEME–91-01-DOC-2, pp. 282-296) **A map of France's opportunities: where and how install wood boiler plants.** Cornut, B. (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France)). Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9110513–: Colloquium on new data on the use of energy from wood, Paris (France), 15-16 Oct 1991). In *New data on the use of energy from wood.* 489p. Order Number DE94700005. Source: OSTI; NTIS (US Sales Only).

Based on existing wood boiler plant statistics in France, a survey of economical and wood supply parameters involved in a site decision, is presented: climate parameters (temperature and degree-days), investment and running costs, wood supply closeness and combination with gas-oil burners are assessed in order to identify the optimal sites: nor to warm, nor to rude climates, large plants, non-intermittent use facilities, long duration heating periods, etc. will be preferred.

32660 (ADEME–91-01-DOC-2, pp. 298-313) **500 kW and above wood burners for residential heating. Equipment supply.** Salvi, P. Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9110513–: Colloquium on new data on the use of energy from wood, Paris (France), 15-16 Oct 1991). In *New data on the use of energy from wood.* 489p. Order Number DE94700005. Source: OSTI; NTIS (US Sales Only).

Wood furnace type for large residential heating (more than 500 kW) is strongly dependent of the wood fuel type (platelets, wastes, sawdust, barks, ...); the various furnace manufacturers in France are reviewed and their equipment range described: wood fuel type, humidity tolerance, granulometry, power range, and references of installed plants. Site equipment is also reviewed: storage silos, extraction and handling systems, burner supply system, burner types, fume dust extraction, ash removal, dimensioning and cost evaluation.

32661 (ADEME–91-01-DOC-2, pp. 389-398) **All-fluid, all-process, all-sector: cogeneration, a high-tech experience.** Lucien-Brun, B. (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France)). Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9110513–: Colloquium on new data on the use of energy from wood, Paris (France), 15-16 Oct 1991). In *New data on the use of energy from wood.* 489p. Order Number DE94700005. Source: OSTI; NTIS (US Sales Only).

A wood cogeneration process experimental plant in a large sawmill in France is presented and evaluated: evaluation of the wood supply on the site, drying vapor requirements, electricity demand characteristics; the various cogeneration system architectures are presented and the selected system is detailed: three different wood fuels are used and are transferred together with an automatic device; the water tube boiler is fully equipped with automatic supply, regulation, ash removal, dust cleaning, etc. Electricity is produced by a turbo-alternator (Worthington type). Operation results after one year of utilization are presented (drying performance and electric power production).

32662 (ADEME–91-01-DOC-2, pp. 399-418) **A diffusion experiment for wood boiler plants and its induced effects in Aquitaine.** Fraysse, J.M. (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France)); Estournes, M. Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9110513–: Colloquium on new data on the use of energy from wood, Paris (France), 15-16 Oct 1991). In *New data on the use of energy from wood.* 489p. Order Number DE94700005. Source: OSTI; NTIS (US Sales Only).

Aquitaine (SW of France) has the largest forest area in Western Europe and is fully equipped with a strong and integrated organization (forestry, forest protection, wood collection, wood transport, sawmill and paper mill, etc.). Local authorities together with national organizations such as AFME (energy management agency) have encouraged wood fuel utilization and wood boiler plant development. Statistics concerning the development of heating plants and waste processing systems are given; the effects of wood wastes or small wood utilization in burner systems on the Aquitaine economics are discussed. Ecological aspects are also shown.

32663 (ADEME–91-01-DOC-2, pp. 446-454) **The development of energy from wood in Europe.** Corte, P. Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9110513–: Colloquium on new data on the use of energy from wood, Paris (France), 15-16 Oct 1991). In *New data on the use of energy from wood.* 489p. Order Number DE94700005. Source: OSTI; NTIS (US Sales Only).

Statistics concerning forest surfaces, wood supply, wood consumption and wood consumption for energy production are given for the various european countries. Potential use of wood for energy production is also assessed. The energy-from-wood systems are very different from one country to another, induced by differences in property type, harvesting systems and organizations, wood types and prices, etc. Energy prices for individual heating and industrial uses are compared as a function of fuel type (electricity, natural gas, fuel, wood logs, sawdust and bark) and as a function of country. The various european and EEC research and development programs are reviewed.

32664 (ADEME–91-01-DOC-2, pp. 455-463) **High-performance utilization of energy from wood in Austria.** Kopetz, H. Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9110513–: Colloquium on new data on the use of energy from wood, Paris (France), 15-16 Oct 1991). In *New data on the use of energy from wood.* 489p. Order Number DE94700005. Source: OSTI; NTIS (US Sales Only).

Statistics concerning energy production and consumption, wood and wood for energy conversion consumption in Austria are presented. Four utilization modes for biogenic resources are described: wood log heating in households, wood chip combustion in households and industrial plants, heating plants near villages and towns, industrial wood waste combustion. Economical and ecological benefits from wood combustion for energy production are assessed and the different political and financial incentives in Austria are presented.

32665 (ADEME–91-01-DOC-2, pp. 465-477) **High-performance utilization of energy from wood in Portugal.** Olivera, P. Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9110513–: Colloquium on new data on the use of energy from wood, Paris (France), 15-16 Oct 1991). In *New data on the use of energy from wood.* 489p. Order Number DE94700005. Source: OSTI; NTIS (US Sales Only).

The main projects for energy conversion from wood (space heating and hot water production) in Portugal, are presented: wood platelets, almond shells, pine cone wastes, vine shoots, olive marc, etc. may be manually, semi-automatically or fully-automatically supplied to the burner; different burner types are used and various heating systems are investigated (floor heating, distributed or traditional systems); locations and characteristics of the different projects are summarized.

32666 (ADEME–91-01-DOC-2, pp. 479-486) **Comparison of the regulations among various countries concerning wood combustion pollutant emissions in the atmosphere.** Fontelle, M. Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9110513–: Colloquium on new data on the use of energy from wood, Paris (France), 15-16 Oct 1991). In *New data on the use of energy from wood.* 489p. Order Number DE94700005. Source: OSTI; NTIS (US Sales Only).

Numerous substances issued from wood combustion are emitted in the atmosphere: dust, nitrogen oxides, carbon dioxide and monoxide, volatile organic compounds, etc. Regulations concerning wood combustion equipment are very diversified depending of the country; dusts are generally covered by regulations, but NOx, CO, hydrocarbons, etc. occasionally. Limit values which are determined by the different countries are presented and compared as a function of associated parameters such as plant power, installation age and site, operation conditions, wood type, burner type, etc.

32667 (NEI-DK–1268) **The use of straw in primary power plants.** Elsamprojekt A/S, Fredericia (Denmark). Dec 1992. 46p. (In Danish). Order Number DE93525265. Source: OSTI; NTIS.

Experiments were carried out by a Danish electricity company on the use of straw as fuel in four of the company's primary power plants. In Denmark the amount of surplus straw available for fuel is ca. 1.1 million tons. EEC set-aside policy will result in a reduction of this amount. The price would be ca. 300 Danish kroner per ton. In the case of Grenaa power plant straw consumption would be 28 tons/hr, storage capacity would be 600 tons (24 hrs use). In Vestkraft power plant it would be possible to combust straw and coal together where straw mass comprised 10% of the total. Very few straw particles were found in the fly ash, but the coal grinder's capacity was reduced to 70% of normal. When the straw was blown straight into the combustion chamber, it constituted 16% of the total fuel in the boiler. 560 tons of straw were burnt, combustion was satisfactory, hardly any straw particles were found in the fly ash but unburnt straw joints were found in the slag. In Midtkraft power plant straw was combusted in a spreader-stoker fired boiler. Straw constituted ca. 30% of the total fuel combusted and was stoked directly into the combustion chamber. Straw lengths of 50-2000mm is burnt very satisfactorily, sulphur dioxide emission was reduced but corrosion was found in some components in contact with the flue gas. Chlorides, alkali and sulphur oxides were found in the fly ash. Results of all these experiments were on the whole positive. The main problems were corrosion, the contamination of fly ash with potassium and the need for a stoking concept allowing for firing of large amounts of straw over the whole of the boilers stoking area. (AB) (15 refs.)

32668 **Slow combustion, multi-fuel, gravity feed stove.** Walsh, R.C. 16 Jan 1993. Filed date 15 Jul 1991. Canada patent application 2047099. 13p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

A solid fuel stove for burning a wide range of solid fuels is disclosed. The stove may burn wood pellets, sawdust, corn kernels or ears, corncobs, compressed organic material, and the like. It has an interior fuel hopper located within the firebox for gravity feed to the combustion zone in order to provide economic and controlled slow combustion at high efficiency and low creosote formation. In

one embodiment, the combustion zone is located between upper and lower sets of grate bars. The fuel zone and combustion zone are bounded on the back face by a flue leading to a stovepipe or chimney. The intervening wall extends downward to the combustion zone, forming a baffle, the height of which controls conditions of the flue gas and its circulation. This baffle tends to preclude combustion within the fuel hopper. A variable flue gas deflector may be located adjacent the flue wall to facilitate combustion control. The fuel hopper may be removable to facilitate the use of the stove with conventional logs. In operation, a small fire is lit in the combustion zone to achieve at least 650°F stack temperature, after which fuel is deposited in the fuel hopper and the stove closed up. Air supply is left open to establish combustion at the desired rate. Restriction of the air supply by adjusting the draft control permits long burn operation which can be stabilized in the desired range, giving a chimney temperature of ca 100°F. 5 figs.

0930 Economic, Industrial, and Business Aspects

Refer also to citation(s) 32638, 32646, 32648, 32650, 32658, 32659, 32660, 32662, 32663, 32664, 32665, 32671

0940 Transport, Handling, and Storage

Refer also to citation(s) 32660

0950 Environmental Aspects

Refer also to citation(s) 32644, 32645, 32646, 32651, 32654, 32657, 32666, 32670, 32671, 33002, 33097, 33100

32669 (ADEME–91-01-DOC-1, pp. 1-32) **Biomass and the carbon cycle.** Gosse, G. (Institut National de Recherches Agronomiques (INRA), 75 - Paris (France)). Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9111328–: Colloquium on biomass: an energy source for the quality of environment, Paris (France), 27-28 Nov 1991). In *Biomass: an energy source for the quality of environment.* 245p. Order Number DE94700004. Source: OSTI; NTIS (US Sales Only).

The greenhouse effect and its evolution are reviewed and the influence of human activities on the soil-vegetation behaviour is examined: the carbon cycle induced by such activities as deforestation and tropical savannah cultivation development, is studied. It is shown that energy production from agricultural and forest substrates could significantly reduce greenhouse effect gas emissions and especially CO2 emissions. Short and mean term efficiencies of various methods for reducing such emissions are compared: energy conservation means, fossil fuel consumption reductions, biomass utilization.

0960 Health and Safety

Refer also to citation(s) 33105

0970 Legislation and Regulations

Refer also to citation(s) 32652, 32657, 32666

32670 (ADEME–91-01-DOC-1, pp. 79-80) **Economical instruments for greenhouse effect abatement: an opportunity for biomass.** Hourcade, J.C. Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9111328–: Colloquium on biomass: an energy source for the quality of environment, Paris (France), 27-28 Nov 1991). In *Biomass: an energy source for the quality of environment.* 245p. Order Number DE94700004. Source: OSTI; NTIS (US Sales Only).

Two main economical instruments may be used in the international framework in order to reduce greenhouse effect gas emissions: taxes (proposed by european countries) and duties for pollution (proposed by USA); for political and strategical reasons, taxes should be the solution. Taxes could be either assigned to precise programs (energy conservation, fuel substitution, tree plantations, ...), or non-assigned and attributed to pollutant emitters. Elasticity over energy consumption prices is analyzed and the risk of negative impact of a tax imposed on carbon or energy, on the macro-economic evolution is evaluated and shown to be positive for enhancing biofuel competitivity over conventional fuels.

0980 Waste Management

Refer also to citation(s) 32662

32671 (ENEA-RT-AMB–92-05) **Solid municipal waste management: Systems and reference technologies.** Ciancio, G. (ENEA, Casaccia (Italy). Area Energia Ambiente e Salute); Mura, A. Mar 1993. 88p. (In Italian). (RT/AMB–92-05). Order Number DE93522971. Source: OSTI; NTIS (US Sales Only); INIS.

The management of solid municipal wastes comprises simple methods such as dumping into suitably controlled waste disposal sites, and more complex solutions, which can include waste segregation, some form of materials and/or energy recovery, and the use of combined cycle combustion systems. All these methods, however, require environmental protection systems with custom designed techniques, equipment and safeguards. This paper reviews the technical-economic aspects of different pollution control options currently available to meet the specific requirements of various waste management alternatives.

32672 (ENEA-RT-AMB–92-10) **Refuse derived fuel combustion tests on experimental ABI-2000 pilot incineration plant.** Coronidi, M. (ENEA, Casaccia (Italy). Area Energia Ambiente e Salute); De Stefanis, P.; Di Palo, C.; Ranaldi, E. Mar 1993. 38p. (In Italian). (RT/AMB–92-10). Order Number DE93522970. Source: OSTI; NTIS (US Sales Only).

Performance tests were performed on the ENEA (Italian Agency for New Technology, Energy andEnvironment) experimental ABI-2000 pilot incineration plant which incorporates two types of combustion systems - a 1.8 MW(t) fluidized bed combustor and a 775 mm diameter by 5 m rotating drum incinerator. The fluidized bed combustor is designed to burn solid (less than 25 mm particle size) fuels such as coal and refuse derived fuels, mechanically dried urban and municipal waste sludges, and residual fuels from refineries. The rotating drum incinerator, coupled with a post combustion system, is designed to burn toxic and noxious wastes, plastics, wood wastes, as well as, solvents and waste oils. The pollution control system consists of two distinct sections: a wet scrubbing system, which incorporates a spray dryer, cyclone separator, jet and Venturi scrubbers; and a dry bag filtering (nomex) system. This paper provides brief descriptions of the tandem incinerator plant's design characteristics, key process parameters and performance test results indicating combustion quality and exhaust emission (e.g., nitrogen and sulfur oxides, dusts, heavy metals, etc.) chemical composition and pollutant concentration levels. The paper concludes with a review of the future research aims of ENEA in the field of energy efficient and environmentally safe municipal-industrial waste management.

0990 Products and By-Products

Refer also to citation(s) 33098, 33099, 33749

32673 (NEDO-P–9213) **Research on possibility of utilization of palm methylester for diesel engines.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1993. 174p. (In Japanese). Sponsored by New Energy and Industrial Technology Development Organization, Tokyo (Japan). Order Number DE93520883. Source: OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan.

It is expected that palm oil will reduce black smoke/particulates in exhaust gas from the diesel engine. Therefore, an investigation for practical application of palm oil is made on adaptability as a fuel oil and supply potential. For utilization of palm oil to diesel engines, it is necessary to depress a pour point by methylesterification (methylester (ME) oil) and blending with light oil. When using ME oil, such improvements are seen as improved fuel consumption per heat quantity, reduced emission of black smoke/

particulates and reduced emission of sulfur oxide; however, reduced emission of nitrogen oxide cannot be expected. When using ME Oil in Japan, 4,940,000 tons are required if it is blended with light oil at an average blending rate of 20%. In Malaysia, which is the largest palm oil producing country, production was 6,140,000 tons in 1991 and is estimated to be 7,600,000 tons in 1995 and 8,750,000 tons in 2000. For utilization of palm oil, supply potential of Indonesia is also expected. 42 figs., 47 tabs.

10 SYNTHETIC FUELS

1002 Production

Refer also to citation(s) 32154, 33324, 33325

32674 (CONF-9308106–1) **Three immobilized-cell columnar bioreactors for enhanced production of commodity chemicals.** Davison, B.H.; Scott, C.D.; Kaufman, E.N. Oak Ridge National Lab., TN (United States). [1993]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 1. biomass conference of the Americas; Burlington, VT (United States); 30 Aug - 2 sep 1993. Order Number DE93017759. Source: OSTI; NTIS; GPO Dep.

Immobilized-cell fluidized-bed bioreactors (FBRS) can be used with a variety of fermentations to increase production of fuels, solvents, organic acids, and other fermentation products. Part of the increased rates and yields are due to the immobilization of the biocatalyst at high concentrations. This FBR system with immobilized Zymomonas mobiles increased ethanol productivity more than tenfold with 99% conversion and near stoichiometric yields. FBRs also offer several additional modes of operation for simultaneous fermentation and separation to further increase production by removing the inhibitory products directly from the continuous fermentation. The production of lactic acid by immobilized Lactobacillus was augmented with the addition and removal of solid adsorbent particles to the FBR. An immiscible organic extractant also was used to extract butanol from the acetone-butanol fermentation by Clostridium acetobutylicum. Demonstrations with these FBR systems have already shown definite advantages by improved overall product yields (decreasing feed costs) and by increased rates (decreasing capital and operating costs). Further demonstration and scale-up continue.

32675 (DOE/MC/29228–3407) **Selective methane oxidation over promoted oxide catalysts: Quarterly technical progress report, December 1, 1992–February 28, 1993.** Klier, K.; Herman, R.G.; Sarkany, J.; Sun, Q. Lehigh Univ., Bethlehem, PA (United States). Zettlemoyer Center for Surface Studies. Mar 1993. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG21-92MC29228. Order Number DE93040002. Source: OSTI; NTIS; GPO Dep.

Sulfate anion was used to modify the surface basicity of 1 wt% Sr/La_2O_3, and catalytic tests were carried out to probe the selective oxidation of methane to C_2 coupling products over these catalysts. Over a range of reaction temperatures of 500–700°C, most of the catalytic tests were carried out with a 1 wt% SO_4^{2-}/1 wt% $Sr/La_2O_3$with a CH_4/air = 1/1 reactant mixture at 1 atm and with a gas hourly space velocity (GHSV) = 70,000 *l*/kg catal/hr. The sulfated catalyst showed the largest improved catalytic effect at 500°C. Compared to the activity of the nonsulfated Sr/La_2O_3, the sulfated catalyst resulted in enhancement of the methane conversion, the C_2 selectivity, and the yield of C_2 products. In situ laser Raman spectroscopy was used to characterize the surface of sulfated and nonsulfated catalysts. Preliminary results indicate that the sulfate anion preferentially bonded to the Sr rather than to the La ions. The promoting effect of the acidic sulfate on the catalytic activity of basic Sr/La_2O_3 seems to be due to the inhibition of carbonate formation on the surface Sr ions.

32676 (DOE/PC/89786–T17) **A novel process for methanol synthesis: Progress report, March 1, 1993–May 31, 1993.** Tierney, J.W.; Wender, I. Pittsburgh Univ., PA (United States). Dept. of Chemical and Petroleum Engineering. [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-89PC89786. Order Number DE93019784. Source: OSTI; NTIS; GPO Dep.

A bench-scale reactor is being used to conduct studies of the conversion of synthesis gas to methanol (MeOH) in the liquid phase by a novel process. In previous reports, we provided evidence for a two step reaction in series, the carbonylation reaction mainly taking place close to the copper chromite surface, and the hydrogenolysis reaction taking place on the surface of the copper chromite. The interaction between the two catalysts enhances the rate of MeOH formation. We have previously shown that, under present operating conditions, the methyl formate (MeF) concentration is not in equilibrium. The presence of H_2O results in a drop in the rate of MeF generation by the carbonylation reaction. In this quarter work has continued on the effect of water on the reaction.

32677 (DOE/PC/91028–T6) **High pressure synthesis gas conversion: Task 3: High pressure profiles.** Arkansas Univ., Fayetteville, AR (United States). Dept. of Chemical Engineering. May 1993. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC91028. Order Number DE93040517. Source: OSTI; NTIS; GPO Dep.

The purpose of this research project was to build and test a high pressure fermentation system for the production of ethanol from synthesis gas. The fermenters, pumps, controls, and analytical system were procured or fabricated and assembled in our laboratory. This system was then used to determine the effects of high pressure on growth and ethanol production by C. 1jungdahlii. The limits of cell concentration and mass transport relationships were found in CSTR and immobilized cell reactors (ICR). The minimum retention times and reactor volumes were found for ethanol production in these reactors.

32678 (DOE/PC/92117–T3) **Bioconversion of coal-derived synthesis gas to liquid fuels: Quarterly technical progress report, April 1, 1993–June 30, 1993.** Jain, M.K.; Worden, R.M.; Grethlein, H. Michigan Biotechnology Inst., Lansing, MI (United States). 16 Jul 1993. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92PC92117. Order Number DE93041243. Source: OSTI; NTIS; GPO Dep.

The overall objective of the project is to develop two stage fermentation process for conversion of coal-derived synthesis gas to a mixture of alcohols. This is achieved in two steps. In the first step, B .methylotrophicum converts carbon monoxide (CO) to butyric and acetic acids. Subsequent fermentation of the acids by Clostridium acetobutylicum leads to the production of butanol and ethanol. The tasks for this quarter were: Development/isolation of superior strains for fermentation of syn gas; optimization of process conditions for fermentation of syn gas; evaluation of bioreactor configuration for improved mass transfer of syn gas; and optimization of process conditions for reducing carbon and electron loss by H_2-CO_2 fermentation.

1004 Combustion

Refer also to citation(s) 33127

1008 Waste Management

Refer also to citation(s) 32971

13 HYDRO ENERGY

1301 Resources and Availability

Refer also to citation(s) 33042, 33410

1306 Environmental Aspects

Refer also to citation(s) 32988, 33002

32679 (ANL/EAIS/CP–80295) **Use of aerial videography to evaluate the effects of Flaming Gorge Dam operations on natural resources of the Green River.** Snider, M.A.; Hayse, J.W.; Hlohowskyj, I.; LaGory, K.E.; Greaney, M.M.; Kuiper, J.A.; Van Lonkhuyzen, R.A. Argonne National Lab., IL (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9305250–1: 14. biennal workshop on color photography and videography in resource monitoring, Logan, UT (United States), 25-29 May 1993). Order Number DE93017747. Source: OSTI; NTIS; INIS; GPO Dep.

Peaking hydropower operations can profoundly alter natural stream flow and thereby affect the natural resources dependent on these flows. In this paper, we describe how aerial videography was used to collect environmental data and evaluate impacts of hydropower operations at Flaming Gorge Dam on natural resources of the Green River. An airborne multispectral video/radiometer remote sensing system was used to collect resource data under four different flow conditions from seven sites (each about one mile in length) located downstream from the dam. Releases from Flaming Gorge Dam during data collection ranged from approximately 800 to 4,000 cubic feet/sec (cfs), spanning most of the normal operating range for this facility. For each site a series of contiguous, nonoverlapping images was prepared from the videotapes and used to quantify surface water area, backwater habitats, and areas of riparian vegetation under varying flow conditions. From this information, relationships between flow and habitat parameters were developed and used in conjunction with hydrologic modeling and ecological information to evaluate impacts of various modes of operation.

32680 (DOE/BP/17460–1) **John Day River Subbasin fish habitat enhancement project: Annual report 1991.** Neal, J.A.; Jerome, J.P.; Delano, K.H. Oregon Dept. of Fish and Wildlife, John Day, OR (United States). Jun 1993. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract BI79-84BP17460. Order Number DE93018973. Source: OSTI; NTIS; GPO Dep.

The purpose of the John Day Fish Habitat Enhancement Program is to enhance production of indigenous wild stocks of spring chinook and summer steelhead within the subbasin through habitat enhancement and access improvement. The John Day River system supports the largest remaining wild runs of spring chinook salmon and summer steelhead in northeast Oregon. It is the goal of this program to preserve and enhance the unique genetic component of the stocks. By attaining this goal we will be able to rebuild fish runs in other Columbia River tributaries in the future, if desired. During 1991, 5 leases were signed adding 5.25 miles of stream to the program. Fence construction included 9.95 miles of riparian fence and 15 livestock water crossings. We constructed 3 log wiers for adult salmon holding, added 280 ft. of new channel, and placed 274 fish habitat boulders, 6 trees and 31 rootwads for juvenile rearing. We constructed 15 stream deflectors and 274 linear feet of bank riprap for streambank stabilization.

32681 (DOE/EA–0822) **Snake River sockeye salmon Sawtooth Valley Project: 1993 juvenile and adult trapping program: Final Environmental Assessment.** USDOE Bonneville Power Administration, Portland, OR (United States). Apr 1993. 18p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93016650. Source: OSTI; NTIS; GPO Dep.

Sockeye salmon (Onchorynchus nerka) runs in the Snake River have severely declined. Redfish Lake near Stanley, Idaho, is the only lake in the drainage known to still support a run. In 1989, two adults were observed returning to this lake, and, in 1990, none were observed. In the summer of 1991, only four adults returned, and in the summer of 1992 one male adult returned. On November 20, 1991, the National Marine Fisheries Service (NMFS) declared the Snake River sockeye salmon endangered, effective December 20, 1991, pursuant to the Endangered Species Act of 1973, as amended. Bonneville Power Administration proposes to continue funding the sockeye salmon captive broodstock program begun in the spring of 1991. In 1991 and 1992, BPA funded efforts to conserve and begin rebuilding the Snake River sockeye salmon run. The initial efforts focused on Redfish Lake in the Sawtooth Valley of southcentral Idaho. The 1991 and 1992 measures involved: trapping some of the juvenile outmigrants from Redfish Lake and Alturas Lake and rearing them at the Eagle Fish Health Laboratory near Boise, Idaho; upgrading of the Eagle facility where the juvenile outmigrants and progeny from the adults trapped and spawned in late 1991 are being reared; and trapping adult Snake River sockeye salmon returning to Redfish Lake and holding and spawning them at the Sawtooth Hatchery near Stanley, Idaho, and rearing their progeny.

14 SOLAR ENERGY

1401 Resources and Availability

Refer also to citation(s) 33784

1405 Solar Energy Conversion

Refer also to citation(s) 33258, 33320, 33800

32682 (DOE/FTR–93014805) **Travel to Japan and India to discuss photovoltaic program strategies and funding: Foreign trip report, February 3–16, 1992.** Surek, T. National Renewable Energy Lab., Golden, CO (United States). 1 Apr 1992. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE93014805. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report covers my foreign travel to Japan and India from February 3–16, 1992. For the Indian portion of the trip, I was part of a nine-member DOE delegation. Much of the technical information from PVSEC-6 and India is covered in the trip reports by the other DOE team members. In this report, I therefore focus on the Japanese portion of my trip and Make additional comments and observations on the India trip. In Tokyo, I met with PV program managers from Japan's New Energy and Industrial Technology Development Organization (NEDO), the Sunshine Project, and Photovoltaic Power Generation Technology Research Association (PVTEC). The Japanese photovoltaics (PV) program is undergoing review and plans are being made for the next four-year program (FY 1993–FY 1996). Funding for PV (and solar energy, in general) has been decreasing in Japan since about 1985. A new project in FY 1992 (to start April 1992) is a $9.4 million cost-shared systems program with municipal governments. Two-thirds of the cost for 1050 kill size systems will be paid by the Japanese government with the municipality paying the other one-third. Through candid discussions with the PV program managers at the various organizations, I developed an understanding of how the various agencies operate. I found the managers to be frustrated by their lack of understanding of the technology (they change assignments every two years) and by the decreasing support for the programs. I anticipate that the new Japanese four-year program will expand support for polycrystalline thin films and III-V materials, and for manufacturing technology and systems development.

32683 (DOE/FTR–93014870) **Travel to India to present paper on $CuInSe_2$ type materials at solar cell materials conference: Foreign trip report, February 5–24, 1992.** Deb, S.K. National Renewable Energy Lab., Golden, CO (United States). 24 Mar 1992. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE93014870. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The primary purpose of this trip was to organize and participate in the 2nd Workshop on the Indo-US Cooperative Program on Amorphous Silicon under the Science and Technology Initiative started by President Reagan and Prime Minister Gandhi. An additional objective was to participate in the PVSEC-6 Conference, to present a paper on $CuInSe_2$ type materials and devices, and to chair a session. This trip report gives the highlights of the Conference, the Workshop, and the STI Review Meeting.

32684 (ENEA-RT-INN–91-02) **Separation of gallium by hydro-metallurgical processes.** Casarci, M. (ENEA, Casaccia (Italy). Area Energia e Innovazione). 1992. 43p. (In Italian). (RT/INN–91-02). Order Number DE93522940. Source: OSTI; NTIS (US Sales Only).

This report is one of a monographic series that the author intends to write about some precious and strategic metals for advanced technological applications. The aim is to show, on the basis of a bibliographic review, the 'state of the art' of extraction and purification methods and to propose R&D programs for the ENEA (Italian Agency for Energy, New Technologies and the Environment) Trisaia 'Rare Earth' project. Attention here is given to hydro-metallurgical methods for the separation of gallium, an interesting semiconductor material. The methods considered involve: the use of aluminate solutions in liquid-liquid extraction; solvent extraction from sodium hydroxide by alkylated hydroxyquinoline; and recovery from B ayer liquids with the use of an amidoxime resin; and separation from strongly alkaline liquors by extraction with kelex 100 impregnated resin.

32685 (NREL/TP–411-5654) **Research on stable, high-efficiency amorphous silicon multijunction modules: Annual subcontract report, 1 January 1992–28 February 1993.** Guha, S. (United Solar Systems Corp., Troy, MI (US)). National Renewable Energy Lab., Golden, CO (United States); United Solar Systems Corp., Troy, MI (United States). Jul 1993. 64p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE93010046. Source: OSTI; NTIS; GPO Dep.

This report describes the progress made during Phase 2 of the R&D program to obtain high-efficiency amorphous alloy multijunction PV (photovoltaic) modules. The highlight of the work includes: (1) demonstration of world-record small-area efficiency of 11.2% after one-sun light-soaking at 50°C for 600 h using a dual band gap, double-junction structure; and (2) demonstration of initial module efficiency of 10.6% over 0.09-m^2 (1-ft^2) area using the same double-junction approach. In addition, fundamental studies on material properties and cell performance have shown an interesting correlation between microstructure in the material and cell efficiency both in the initial and light-degraded conditions.

32686 (NREL/TP–451-5354) **Gallium arsenide-based ternary compounds and multi-band-gap solar cell research: Final subcontract report, 1 April 1988–31 March 1990.** Vernon, S. (Spire Corp., Bedford, MA (United States)). National Renewable Energy Lab., Golden, CO (United States); Spire Corp., Bedford, MA (United States). Jul 1993. 168p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE93010049. Source: OSTI; NTIS; GPO Dep.

This report describes work to achieve a high-efficiency, low-cost solar cell. The basic approach to the problem is centered upon the heteroepitaxial growth of a III-V compound material onto a single-crystal silicon wafer. The growth technique employed throughout this work is metal-organic chemical vapor deposition. The silicon wafer may serve as a mechanical substrate and ohmic contact for a single-junction device, or it may contain a p-n junction of its own and form the bottom cell of a two-junction tandem solar cell structure. The III-V material for the single-junction case is GaAs, and for the two-junction case it is either GaAlAs or GaAsP, either material having the proper composition to yield a band gap of approximately 1.7 eV. Results achieved in this contract include (1) a 17.6%-efficient GaAs-on-Si solar cell; (2) an 18.5%-efficient GaAs-on-Si concentrator solar cell at 400 suns; (3) a 24.8%-efficient GaAs-on-GaAs solar cell; (4) a 28.7%-efficient GaAs-on-GaAs concentrator solar cell at 200 suns; (5) the measurement of the effects of dislocation density and emitter doping on GaAs cells; and (6) improvements in the growth process to achieve reproducible thin AlGaAs window layers with low recombination velocities and environmental stability.

32687 (NREL/TP–451-5651) **Research on defects and transport in amorphous-silicon-based semiconductors: Annual subcontract report, 20 February 1992–19 February 1993.** Schiff, E.A. (Syracuse Univ., NY (US)); Gu, Q.; Wang, Q. National Renewable Energy Lab., Golden, CO (United States); Syracuse Univ., NY (United States). Aug 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE93017117. Source: OSTI; NTIS; GPO Dep.

This report describes Phase 2 progress in two areas: (1) electron drift and conduction band tails in a-$Si_{1-x}Ge_x$:H and a-$Si_{1-x}C_x$:H alloys, and (2) optical bias effects on electron trapping and emission in a-Si:H. The authors completed a comprehensive study of electron drift in a-$Si_{1-x}Ge_x$:H alloys, including correlations of the drift parameters with "blue" fill factor measurements and open-circuit voltages in solar cells. They began a study of electron and hole drift in a-$Si_{1-x}C_x$:H, but, at present, they have only confirmed that C alloying degrades the electron drift mobility in a-$Si_{1-x}C_x$:H. They completed a study of optical bias effects on transient photocharge measurements in a-Si:H, which clarified that optical bias effects found in earlier photocurrent transient measurements occur because deep trapping is suppressed by optical bias.

32688 (NREL/TP–451-5652) **Polycrystalline thin-film cadmium telluride solar cells fabricated by electrodeposition: Annual subcontract report, 20 March 1992–19 March 1993.** Trefny, J.U. (Colorado School of Mines, Golden, CO (US)); Furtak, T.E.; Wada, N.; Williamson, D.L.; Kim, D. National Renewable Energy Lab., Golden, CO (United States); Colorado School of Mines, Golden, CO (United States). Aug 1993. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE93018201. Source: OSTI; NTIS; GPO Dep.

This report describes progress during the first year of a 3-year program at Colorado School of Mines, based upon earlier studies performed by Ametek Corporation, to develop specific layers of the Ametek n-i-p structure as well as additional studies of several transparent conducting oxides. Thin films of ZnO and ZnO:Al were deposited under various conditions. For the n-layer of the Ametek structure, a dip-coating method was developed for the deposition of CdS films. The authors also present data on the characterization of these films by X-ray diffraction, Raman spectroscopy, scanning tunneling microscopy, small-angle X-ray scattering, and other techniques. They made progress in the electrodeposition of the CdTe i-layer of the Ametek structure. They developed appropriate electrochemical baths and are beginning to understand the role of the many experimental parameters that must be controlled to obtain high-quality films of this material. They explored the possibility of using an electrochemical process for fabricating the ZnTe p-layer. Some preliminary success was achieved, and this step will be pursued in the next phase. Finally, they fabricated a number of "dot" solar cells with the structure glass/SnO_2/CdS/CdTe/Au. Several cells with efficiencies in the range of 5%-6% were obtained, and they are confident, given recent progress, that cells with efficiencies in excess of 10% will be achieved in the near future.

32689 (SAND–92-7007) **Photovoltaic concentrator initiative: Concentrator cell development.** Wohlgemuth, J.H. (Solarex Corp., Frederick, MD (US)); Narayanan, S. Sandia National Labs., Albuquerque, NM (United States); Solarex Corp., Frederick, MD (United States). May 1993. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018505. Source: OSTI; NTIS; GPO Dep.

This project involves the development of a large-area, low-cost, high-efficiency concentrator solar cell for use in the Entech 22-sun linear-focus Fresnel lens concentrator system. The buried contact solar cell developed at the University of New South Wales was selected for this project. Both Entech and the University of New South Wales are subcontractors. This annual report presents the program efforts from November 1990 through December 1991, including the design of the cell, development of a baseline cell process, and presentation of the results of preliminary cell processing. Important results include a cell designed for operation in a real concentrator system and substitution of mechanical grooving for the previously utilized laser scribing.

32690 (SAND–93-7049) **Silicon concentrator solar cell research.** Green, M.A. (Univ. of New South Wales, Kensington, NSW (AU). Centre for Photovoltaic Devices and Systems); Zhao, J.; Wang, A.; Dai, X.; Milne, A.; Cai, S.; Aberle, A.; Wenham, S.R. Sandia National Labs., Albuquerque, NM (United States); New South Wales Univ., Kensington, NSW (Australia). Centre for Photovoltaic Devices and Systems. Jun 1993. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018489. Source: OSTI; NTIS; GPO Dep.

This report describes work conducted between December 1990 and May 1992 continuing research on silicon concentrator solar

cells. The objectives of the work were to improve the performance of high-efficiency cells upon p-type substrates, to investigate the ultraviolet stability of such cells, to develop concentrator cells based on n-type substrates, and to transfer technology to appropriate commercial environments. Key results include the identification of contact resistance between boron-defused areas and rear aluminum as the source of anomalously large series resistance in both p- and n-type cells. A major achievement of the present project was the successful transfer of cell technology to both Applied Solar Energy Corporation and Solarex Corporation.

32691 (SAND–93-7051) **Defect behavior of polycrystalline solar cell silicon.** Schroder, D.K. (Arizona State Univ., Tempe, AZ (US). Center for Solid State Electronics Research); Park, S.H.; Hwang, I.G.; Mohr, J.B.; Hanly, M.P. Sandia National Labs., Albuquerque, NM (United States); Arizona State Univ., Tempe, AZ (United States). Center for Solid State Electronics Research. May 1993. 83p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018490. Source: OSTI; NTIS; GPO Dep.

The major objective of this study, conducted from October 1988 to September 1991, was to gain an understanding of the behavior of impurities in polycrystalline silicon and the influence of these impurities on solar cell efficiency. The authors studied edge-defined film-fed growth (EFG) and cast poly-Si materials and solar cells. With EFG Si they concentrated on chromium-doped materials and cells to determine the role of Cr on solar cell performance. Cast poly-Si samples were not deliberately contaminated. Samples were characterized by cell efficiency, current-voltage, deep-level transient spectroscopy (DLTS), surface photovoltage (SPV), open-circuit voltage decay, secondary ion mass spectrometry, and Fourier transform infrared spectroscopy measurements. They find that Cr forms Cr-B pairs with boron at room temperature and these pairs dissociate into Cr_i^+ and B^- during anneals at 210°C for 10 min. Following the anneal, Cr-B pairs reform at room temperature with a time constant of 230 h. Chromium forms $CrSi_2$ precipitates in heavily contaminated regions and they find evidence of $CrSi_2$ gettering, but a lack of chromium segregation or precipitation to grain boundaries and dislocations. Cr-B pairs have well defined DLTS peaks. However, DLTS spectra of other defects are not well defined, giving broad peaks indicative of defects with a range of energy levels in the band gap. In some high-stress, low-efficiency cast poly-Si they detect SiC precipitates, but not in low-stress, high-efficiency samples. SPV measurements result in nonlinear SPV curves in some materials that are likely due to varying optical absorption coefficients due to locally varying stress in the material.

32692 (SAND–93-7055) **High-efficiency silicon concentrator cell commercialization.** Sinton, R.A. (SunPower Corp., Sunnyvale, CA (US)); Swanson, R.M. Sandia National Labs., Albuquerque, NM (United States); SunPower Corp., Sunnyvale, CA (United States). May 1993. 59p. Sponsored by USDOE, Washington, DC (United States); Electric Power Research Inst., Palo Alto, CA (United States). DOE Contract AC04-76DP00789. Order Number DE93018491. Source: OSTI; NTIS; GPO Dep.

This report summarizes the first phase of a forty-one month program to develop a commercial, high-efficiency concentrator solar cell and facility for manufacturing it. The period covered is November 1, 1990 to December 31, 1991. This is a joint program between the Electric Power Research Institute (EPRI) and Sandia National Laboratories. (This report is also published by EPRI as EPRI report number TR-102035.) During the first year of the program, SunPower accomplished the following major objectives: (1) a new solar cell fabrication facility, which is called the Cell Pilot Line (CPL), (2) a baseline concentrator cell process has been developed, and (3) a cell testing facility has been completed. Initial cell efficiencies are about 23% for the baseline process. The long-range goal is to improve this efficiency to 27%.

1406 Photovoltaic Power Systems

Refer also to citation(s) 32682

32693 (DOE/FTR–93015250) **Travel to Italy for meetings on Solar Photovoltaics Energy Systems: Foreign trip report, May 2–7, 1993.** Chalmers, S.M. National Renewable Energy Lab., Golden, CO (United States). 1 Jun 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE93015250. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Attending the meeting were representatives from Germany, Italy, Japan, Canada, USA, Austria, and the JRC Commission of the European Communities. The author presided as acting chairman of the WG-3 meeting and participated as the US delegate, presenting technical comments directly or as advised by the US Technical Advisory Committee. The first day of the meeting was spent incorporating the technical comments and instruction provided at the TC82 committee meeting for the committee draft of: " Reference Solar Day and Characteristics of the Utility Interface for PV Systems". For the "Reference Solar Day", the USTAG comments, in the main, were accepted, and two examples showing how the procedure may be used will be included on the FCD. Most of the WG-3 work is driven by the PV applications and standards in progress or under development in the committee member countries or the European Communities. From the attached minutes of the Ischia meeting, it is evident that the committee has much work underway that is of interest and importance to the USA PV community. The fourteen action items listed detail the work in progress.

32694 (DOE/FTR–93016247) **Expansion of the Joint US-Brazilian PV Rural Electrification Pilot Project: Foreign trip report, May 23–30, 1993.** Annan, R. (USDOE, Washington, DC (United States)); Taylor, R.; Siegel, J. National Renewable Energy Lab., Golden, CO (United States). 21 Jun 1993. 73p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE93016247. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A broad-based utility meeting was held in Rio sponsored by Eletrobras and its research arm CEPEL (Centro de Pesquisas de Energia Electrica). The purpose of the meeting was to discuss the potential role for renewables in Brazil and was attended by 34 people from utilities, manufacturers, and government agencies. A meeting was held between Robert Airman, the US Ambassador to Brazil, Richard Melton, and US Embassy staff. The purpose of the meeting was to update the Embassy on US-Brazil cooperative activities in Pernambuco and Ceara under the Brazil-US Rural Electrification Program, and next steps. State-level meetings were held with senior government representatives and utilities in Bahia, Ceara, Amazonas, and Acre. As a result of these meetings, DOE agreed to the following: Bahia - cost shared pilot project for productive use of PV in agriculture, Amazonas - cost shared PV stand-alone and PV-diesel hybrid to demonstrate fuel displacement, Acre - assistance in carrying out $4M program for PV in health, education and clean water, Ceara - continued support for solar home systems and Jericoacoara village hybrid.

32695 (NREL/TP–472-5539) **Building integrated photovoltaic systems analysis: Preliminary report.** National Renewable Energy Lab., Golden, CO (United States); ERG International, Inc., Golden, CO (United States). Aug 1993. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE93018208. Source: OSTI; NTIS; GPO Dep.

The National Renewable Energy Laboratory (NREL) has estimated that the deployment of photovoltaics (PV) in the commercial buildings sector has the potential to contribute as much as 40 gigawatts peak electrical generation capacity and displace up to 1.1 quads of primary fuel use. A significant portion of this potential exists for smaller buildings under 25,000 square feet (2,300 square meters) in size or two stories or less, providing a strong cross over potential for residential applications as well. To begin to achieve this potential, research is needed to define the appropriate match of PV systems to energy end-uses in the commercial building sector. This report presents preliminary findings for a technical assessment of several alternative paths to integrate PV with building energy systems.

1407 Solar Thermal Power Systems

Refer also to citation(s) 33028, 33106

32696 (DOE/FTR–93017130) **Travel to Europe to coordinate testing of tower receivers and review status of solar chemical energy storage research: Foreign trip report, June 13–24, 1993.** Tyner, C.E. Sandia National Labs., Livermore, CA (United States). 13 Jul 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DR00789. Order Number DE93017130. Source: OSTI; NTIS (US Sales Only); GPO Dep.

One receiver, a molten salt internal film receiver (IFR) is similar in concept to the Direct Absorption Receiver previously studied in the US. The Spanish Energy Agency CIEMAT, in consultation with us, designed and fabricated a test receiver 3 years ago but were unable to initiate testing due to budget cuts. In the past year, their interest was revived, and they requested our support to help test the concept at the PSA. As part of our cooperation with the IEA/SolarPACES and because of our interest in the IFR concept as an advanced molten salt receiver that might eventually prove to be better and less expensive than salt-in-tube receivers for power tower applications, we agreed to provide technical support to the installation, testing, and evaluation in return for test results. The second receiver is a volumetric air heating receiver (VR) built by Bechtel. The receiver was designed for testing on the PSA VR test stand, which provides all the test support hardware and instrumentation for very cost-effective testing. In return for the data, our test and evaluation support, and $10k provided to the PSA by Bechtel, the PSA agreed to conduct the testing. Both of these test arrangements allow us to conduct advanced receiver tests for a small fraction of the cost of developing the capabilities here. In support of these activities, I spent several days at the PSA (along with Earl Rush, who worked at the site for 3 weeks) consulting on the installation of the VR and salt components, flow testing the IFR, and developing control strategies and test and evaluation plans for the tests.

32697 (SAND–92-2347C) **Procedures for measuring the properties of heat-pipe wick materials.** Adkins, D.R.; Dykhuizen, R.C. Sandia National Labs., Albuquerque, NM (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930804–14: 28. intersociety energy conversion engineering conference, Atlanta, GA (United States), 8-13 Aug 1993). Order Number DE93017649. Source: OSTI; NTIS; GPO Dep.

Accurate measurements of wick properties must be available to design high-performance beat pipes and to properly interpret results from heat pipe tests. In a program that is aimed at developing heat-pipe receivers for solar-Stirling electric systems, we have recently explored procedures to measure the effective pore radius and permeability of wick materials in their final "as fabricated" condition. Measurement techniques are compared in this paper and problems that are frequently encountered in measuring wick properties are discussed.

32698 (SAND–93-7000) **Tehachapi solar thermal system first annual report.** Rosenthal, A. (Southwest Technology Development Inst., Las Cruces, NM (US)). Sandia National Labs., Albuquerque, NM (United States); New Mexico State Univ., Las Cruces, NM (United States). Southwest Technology Development Inst. May 1993. 60p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018443. Source: OSTI; NTIS; GPO Dep.

The staff of the Southwest Technology Development Institute (SWTDI), in conjunction with the staff of Industrial Solar Technology (IST), have analyzed the performance, operation, and maintenance of a large solar process heat system in use at the 5,000 inmate California Correctional Institution (CCI) in Tehachapi, CA. This report summarizes the key design features of the solar plant, its construction and maintenance histories through the end of 1991, and the performance data collected at the plant by a dedicated on-site data acquisition system (DAS).

1409 Solar Thermal Utilization

Refer also to citation(s) 33086

32699 (ADEME–90-04-DOC) **Solar thermal utilization.** Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. 218p. (In French). (CONF-9007258–: Seminar on Solar thermal utilization, Sophia-Antipolis (France), 4-5 Jul 1990). Order Number DE94700006. Source: OSTI; NTIS (US Sales Only).

The main themes of the seminar are: new products and new systems (low cost solar water heater, self-storage solar water heater, integral storage water system, commercial development of solar water heaters and direct solar floor); computer aided design and operation monitoring of solar systems (design handbook and performance computing methods, remote control of collective solar systems (water heaters, direct solar floors), design and diagnostic expert systems); demonstration and operation programs, quality assessment and guarantees; market evaluation.

32700 (ADEME–90-04-DOC, pp. 1-16) **An industrial development program for a low-cost solar water heater.** Giordano, J. Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9007258–: Seminar on Solar thermal utilization, Sophia-Antipolis (France), 4-5 Jul 1990). In *Solar thermal utilization.* 218p. Order Number DE94700006. Source: OSTI; NTIS (US Sales Only).

A mono-bloc solar water heater, manufactured by Giordano, is presented; it is ready-to-use and only connection of the inlet and outlet to the piping is necessary. The capacity is 120 liters and the weight is 30 kg; it has a greenhouse effect with front insulation and the absorber is made of a flexible composite material. Characteristics and performances are given.

32701 (ADEME–90-04-DOC, pp. 17-28) **Performance of self-storage solar water heaters.** Chantant, M. (CEA Centre d'Etudes de Cadarache, 13 - Saint-Paul-lez-Durance (France)). Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9007258–: Seminar on Solar thermal utilization, Sophia-Antipolis (France), 4-5 Jul 1990). In *Solar thermal utilization.* 218p. Order Number DE94700006. Source: OSTI; NTIS (US Sales Only).

A simple integral collector storage system where collection and storage are ensured by the same element (self-storage collector), is studied and a prototype has been realized in order to evaluate its thermal performance limits. A model is then developed to evaluate its yearly efficiency. Recommendations concerning the tank coating, the collector insulation and the transparent layer are derived from the results.

32702 (ADEME–90-04-DOC, pp. 29-40) **Technological development of a vacuum tube storage solar water heater system.** Marini, J. (Societe Franco-Americaine de Constructions Atomiques (FRAMATOME), 92 - Courbevoie (France)). Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9007258–: Seminar on Solar thermal utilization, Sophia-Antipolis (France), 4-5 Jul 1990). In *Solar thermal utilization.* 218p. Order Number DE94700006. Source: OSTI; NTIS (US Sales Only).

The solar collector is composed of a single element, ensuring solar radiation collection and hot water storage: storing is realized by a stainless steel reservoir coated with a low-emissive absorbing black material, which is encapsulated in a high resistance borosilicate glass tube. Vacuum between the tube and the reservoir ensures a good thermal insulation. Hundred of these storage-collector have been manufactured, and various tests have been performed concerning performances, ageing, mechanical resistance during transportation and operation, etc. Commercial development and marketing aspects are discussed.

32703 (ADEME–90-04-DOC, pp. 63-78) **Collective solar installation design handbook; a performance computation method.** Bourdeau, L. (C.S.T.B., 06 - Sophia-Antipolis (France)); Filloux, A. Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9007258–: Seminar on Solar thermal utilization, Sophia-Antipolis (France), 4-5 Jul 1990). In *Solar thermal utilization.* 218p. Order Number DE94700006. Source: OSTI; NTIS (US Sales Only).

This paper presents the main recent evolutions concerning the evaluation of the thermal performances for active solar systems (solar water heaters, direct solar floors), and particularly in the framework of the french certification and regulation systems; tests and evaluation methods are described. The AFME handbook

concerning solar water heater collective equipment is briefly presented.

32704 (ADEME–90-04-DOC, pp. 103-120) **Operation monitoring of individual houses equipped with a direct solar floor.** Papillon, P. (Societe ASDER, 73 - Chambery (France)); Letz, T. Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9007258–: Seminar on Solar thermal utilization, Sophia-Antipolis (France), 4-5 Jul 1990). In *Solar thermal utilization.* 218p. Order Number DE94700006. Source: OSTI; NTIS (US Sales Only).

The different monitored houses and solar floor equipment are described together with the monitoring instruments and methods; measure results are given: monthly and yearly balances are presented; comparisons between measure results and theoretical calculations are discussed; an inquiry among inhabitants revealed a very favourable opinion for the direct solar floor. Heating and hot water expenses and savings are evaluated.

32705 (DOE/FTR–93014984) **IEA Solar Heating and Cooling Program Task 12, building energy analysis and design tools for solar applications and advanced analysis tools workshop in Denmark: Foreign trip report, March 8–14, 1992.** Holtz, M.J. National Renewable Energy Lab., Golden, CO (United States). 15 Apr 1992. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE93014984. Source: OSTI; NTIS (US Sales Only); GPO Dep.

I, on behalf of DOE, am the Operating Agent of Task 12 of the IEA Solar Heating and Cooling Program. This meeting brought together the experts from the twelve participating countries who are working in four approved projects: high performance glazings, daylighting model development, atrium model development and model evaluation. In addition to the working group meetings and plenary sessions, a two day advanced energy analysis tools workshop was held to review the state-of-the-art and discuss a proposed new Task 12 project on advanced tools development. Mr. Ron Judkoff from NREL accompanied me to the meeting.

32706 (DOE/SF/16306–37) **Colorado State University Program for developing, testing, evaluating and optimizing solar heating and cooling systems: Project status report, June–July 1993.** Colorado State Univ., Fort Collins, CO (United States). Solar Energy Applications Lab. Aug 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86SF16306. Order Number DE93040905. Source: OSTI; NTIS; GPO Dep.

This report describes activities of the Colorado State program for developing, testing, evaluating, and optimizing solar heating and cooling systems during the months of June and July, 1993.

32707 (ETSU-S–1160/17) **Solar building study. Final report: Dawbank House, Willow Park, Chorley.** Solar Building Study. Hobday, R.A.; Pane, G.; Palmer, J.; Shaw, P. Databuild, Birmingham (United Kingdom). Mar 1992. 104p. Order Number DE93515076. Source: OSTI; NTIS (US Sales Only).

Work performed under the Energy Performance Assessments (EPA) Project.

An energy performance assessment of the Dawbank House, which is part of a low energy housing scheme in Lancashire, indicated that the total annual fuel use was 26730 kWh of which the space heating fuel requirement was 151 kWh/m^2 of gross floor area. The solar gain from the conservatory and south facing glazing can displace about 20% of the heat required from the space heating systems. The design of the house succeeded in providing a thermally comfortable and visually attractive environment. The Dawbank House was about 7% (Pound 3090) more expensive than an equivalent non-solar house. The difference is due to the conservatory which provided energy and amenity benefits and increased floorspace. Insulation levels in the Dawbank House were above those of the 1990 Building Regulations. (Author)

32708 (ETSU-S–1160/SBS/16) **Solar building study. Summary report: The Cedargrove House.** Solar Building Study. Databuild, Birmingham (United Kingdom). [1992]. 8p. Order Number DE93502502. Source: OSTI; NTIS (US Sales Only).

Work performed under the Energy Performance Assessments (EPA) Project.

Assessment of the costs and benefits of incorporating passive solar principles within the building design of a house indicated that the total annual fuel use of 23320 kWh was low for a four bedroom dwelling. The space heating fuel requirement was 85 kWh/m^2 of gross floor area. The solar gain from the conservatory and south facing glazing can displace up to 25% of the heat required from the space heating system. The design of the house succeeded in providing a thermally comfortable and visually attractive environment and was well liked by the occupants. The house cost 10% more to build than an equivalent non-solar house. This is attributable to the additional cost of the conservatory which provided valuable extra space and amenity benefits. (author)

32709 (ETSU-S–1160/SBS/19) **Solar building study. Summary report: The Mountbatten Sports Hall.** Solar Building Study. Databuild, Birmingham (United Kingdom). [1992]. 8p. Order Number DE93502503. Source: OSTI; NTIS (US Sales Only).

Work performed under the Energy Performance Assessments (EPA) Project.

Assessment of the costs and benefits of incorporating passive solar principles within the building design of a school sports hall indicated that daylight has displaced 21% of the annual electricity used for lighting by daytime adult use of the hall. The design has the potential to save twice this with better automatic lighting controls. Over-heating was not a significant problem. Recommended temperatures were exceeded, but few users complained of over-heating and this was only in the summer. Air quality was acceptable. Daylight alone provided poorer illumination at the centre of the hall than towards the edges. This reduced visibility at the centre of play. The overall cost of the building was slightly below the average for this type of recreational building. The roof-lights added Pound 6,800 to the cost, but enable Pound 1,400 of electricity to be saved per year for typical hours of use. (author)

32710 (ETSU-S–1160/SBS/26) **Solar building study. Summary report: Christopher Taylor Court.** Solar Building Study. Databuild, Birmingham (United Kingdom). [1992]. 8p. Order Number DE93502504. Source: OSTI; NTIS (US Sales Only).

Work performed under the Energy Performance Assessments (EPA) Project.

This report assesses the cost and benefits associated with incorporating passive solar principles within the building design of a sheltered housing scheme. Total annual delivered fuel is 292 kWh per m^2 gross floor area. This is high for a building that is very well insulated. The building is unnecessarily warm; corridors are often at 25°C (the design temperature was 16°C); thermostats in most flats are set to 25°C or above. Poor control over the use of space heating has led to conditions which have almost obscured the impact of solar gain on the building. The mass walls have performed better than the well-insulated cavity walls used. They reduced heat loss by 25% during October to April. Detailed monitoring has suggested that solar gain contributes 5% of all the energy used to heat a flat. The total building cost was near the mean of a sample of similar reference buildings. (author)

32711 (NEI-DK–1233) **Validation of KVIKSOL for the calculation of annual production rates of three types of domestic water systems.** Nielsen, J.E. Dansk Teknologisk Inst., Taastrup (Denmark). Proevestationen for Solenergi. Jan 1993. 77p. (In Danish). Order Number DE93516638. Source: OSTI; NTIS.

A comparison of measurements and calculations related to three types of solar water heating systems. The computer programme KVIKSOL was used for calculation purposes and its accuracy of performance was evaluated. One type of solar water heating system had pump circulation and spiral heat exchangers placed low in the storage tank (Batec), another had low flow circulation with jacket heat exchangers placed in the area from the base to the supplementary energy source (Aidt) and the third was a self-circulating system with prostrate mantle containers (Solahart). (AB)

32712 (NEI-DK–1266) **The thermodynamic solar heating system TE-DY: Preliminary project.** Moerk Thomsen, J. Moerk Thomsen (J.), Smoerum (Denmark). Jun 1993. 20p. (In Danish). Contract ENS-51181-93.0015. Order Number DE93525253. Source: OSTI; NTIS.

The aim was to evaluate solar heating systems tested abroad which are similar to the Danish, recently designed, two-phase thermodynamic system TE-DY, especially with regard to cost and capacity. In America a similar system had been tested at Colorado State University's Solar Applications Laboratory and another commercially successful system was produced by the Sage Advance Corporation. It is concluded that the TE-DY system could be produced to advantage. The price and capacity would be an improvement by 25-50% in relation to traditional Danish solar heating systems. The Danish design comprises a collector, a storage container with an inside heating coil (condensator) and insulated connecting tubes. It is controlled automatically. The collector consists of a glass plate and selective absorber and can be mounted on a roof surface. The absorber is constructed like a submerged evaporator. The solar energy driven pump is worked on steam pressure in a cyclus where the fluid in the collector evaporates when heated by the sun. The steam is led to the heating coil in the storage facility where it gives out heat and is condensed to a liquid after which it is gathered into the pump. When a suitable amount is collected, the inlet valve to the heat storage container is closed automatically. During condensation within the container the steam pressure becomes higher than that within the heating coil. The difference in pressure over the solar pump piston helps to press the liquid into the solar collector again. No electricity is used and no heat loss takes place. The solar collector fluid can consist of regenerated chlorofluorocarbons. (AB)

32713 (NEI-NO–359) **Solar collectors for pre-heating of air for drying grain and hay in Norway.** Tengesdal, G. Norges Landbrukshoegskole, Aas (Norway). 1992. 169p. Order Number DE93525292. Source: OSTI; NTIS.

A brief analysis of crop drying with ambient air in a temperate humid climate is given as an introduction. The significant increase in drying potential that can be achieved with a slight warming of the air makes up the background for the analysis of solar collectors. The bare plate collector built with corrugated metal sheets is the most widely used collector for pre-heating of air for crop drying in Norway. An analysis of the major variables that determine the collectors performance is made, and an equation that can be used to estimate efficiency is suggested. In order to evaluate the potential of other widely used building materials as solar air collectors, black concrete roof tiles and wooden wall boards have been tested as permeable collectors. Measurements of the performance of solar collectors in several farm buildings have been made. Due to several factors that can be hard to determine with good accuracy, the results from such measurements will always be associated with a high uncertainty. Very often, with the flow rates used in preheating of air for crop drying, efficiencies are found in the range 0.4 to 0.6. The extra costs associated with the construction of a solar collector can vary from NOK 20 to NOK 100 per m^2, depending on conditions, material costs and labour costs. If the system is used in a way that it will produce 40 kWh per m^2 and year, the energy price will be less than NOK 0.40 per kWh, with 15% capital costs and depreciation on an investment of NOK 100 per m^2. 92 refs., 80 figs., 13 tabs.

32714 (ORNL/ENG/TM–41) **Operation and maintenance guidance: A procedures manual for solar domestic hot water systems at Camp Darby.** Belk, J.P.; Williams, W.R.; Feldman, M.R.; Wolfgong, J.R.; Horton, J.R.; Anderson, J.C.; Hight, P.H. Oak Ridge National Lab., TN (United States). May 1993. 227p. (In English, Italian). Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93018046. Source: OSTI; NTIS; GPO Dep.

Solar domestic hot water systems have been installed at Camp Darby and the Leghorn Army Depot near Livorno, Italy, by the United States Army. These systems range from single panel installations providing hot water to maintenance shops to large multipanel systems serving barracks. Guidance provided in this bilingual (English-Italian) report includes operating and maintenance procedures and recommendations for spare parts inventory. Operating procedures address start-up, normal operations, shut-down, and response to abnormal conditions; maintenance procedures address collector fluid drainage and replacement and equipment change-out. Flow diagrams reflecting as-built conditions are also included for many of the systems. Water quality and corrosion control are also discussed.

32715 (SAND–92-2131) **The CAESAR project: Experimental and modeling investigations of methane reforming in a CAtalytically Enhanced Solar Absorption Receiver on a parabolic dish.** Muir, J.F. (Sandia National Labs., Albuquerque, NM (US)); Hogan, R.E. Jr.; Skocypec, R.D.; Buck, R. Sandia National Labs., Albuquerque, NM (United States); Deutsche Forschungsanstalt fuer Luft- und Raumfahrt e.V. (DLR), Stuttgart (Germany). Inst. fuer Technische Thermodynamik. Jul 1993. 136p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93040203. Source: OSTI; NTIS; GPO Dep.

A joint US/Federal Republic of Germany (FRG) project has successfully tested a unique solar-driven chemical reactor in the CAtalytically Enhanced Solar Absorption Receiver (CAESAR) experiment. The CAESAR test was a "proof-of-concept" demonstration of carbon-dioxide reforming of methane in a commercial-scale, solar, volumetric receiver/reactor on a parabolic dish concentrator. The CAESAR design; test facility and instrumentation; thermal and chemical tests; and analysis of test results are presented in detail. Numerical models for the absorber and the receiver are developed and predicted performance is compared with test data. Post test analyses to assess the structural condition of the absorber and the effectiveness of the rhodium catalyst are presented. Unresolved technical issues are identified and future development efforts are recommended.

32716 **Solar distiller.** Vanden, B.E. 26 Aug 1992. Filed date 25 Feb 1991. Canada patent application 2036979. 12p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

A solar distiller employs a solar collector, preferably a parabolic reflector, and an enclosed distiller vessel having a near-black face to receive concentrated solar rays. The vessel contains a number of vertical pipes connected to an outflow pipe at their lower ends. A supply of water to be purified is maintained in the vessel at a level below the open upper ends of the vertical pipes. As solar heating of the vessel interior occurs, the water will begin to boil, evaporate, and form water vapor. The purified water vapor is urged under the pressure created within the vessel to enter the vertical pipes, where it is forced into the outflow pipe for subsequent condensation. A secondary heat supply is available from secondary water which is heated during condensation of the purified water. 2 figs.

1410 Solar Collectors and Concentrators

Refer also to citation(s) 32696, 32699, 32700, 32701, 32702, 32703, 32704

32717 (SAND–92-1381) **Testing and evaluation of large-area heliostats for solar thermal applications.** Strachan, J.W.; Houser, R.M. Sandia National Labs., Albuquerque, NM (United States). Feb 1993. 61p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018509. Source: OSTI; NTIS; GPO Dep.

Two heliostats representing the state-of-the-art in glass-metal designs for central receiver (and photovoltaic tracking) applications were tested and evaluated at the National Solar Thermal Test Facility in Albuquerque, New Mexico from 1986 to 1992. These heliostats have collection areas of 148 and 200 m^2 and represent low-cost designs for heliostats that employ glass-metal mirrors. The evaluation encompassed the performance and operational characteristics of the heliostats, and examined heliostat beam quality, the effect of elevated winds on beam quality, heliostat drives and controls, mirror module reflectance and durability, and the overall operational and maintenance characteristics of the two heliostats. A comprehensive presentation of the results of these and other tests is presented. The results are prefaced by a review of the development (in the United States) of heliostat technology.

32718 (SAND–92-2253) **Bench-scale screening tests for a boiling sodium-potassium alloy solar receiver.** Moreno, J.B.; Moss, T.A. Sandia National Labs., Albuquerque, NM (United

States). Jun 1993. 71p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018512. Source: OSTI; NTIS; GPO Dep.

Bench-scale tests were carried out in support of the design of a second-generation 75-kW_t reflux pool-boiler solar receiver. The receiver will be made from Haynes Alloy 230 and will contain the sodium-potassium alloy NaK-78. The bench-scale tests used quartz-lamp-heated boilers to screen candidate boiling-stabilization materials and methods at temperatures up to 750°C. Candidates that provided stable boiling were tested for hot-restart behavior. Poor stability was obtained with single 1/4-inch diameter patches of powdered metal hot-press-sintered onto the wetted side of the heat-input area. Laser-drilled and electric-discharge-machined cavities in the heated surface also performed poorly. Small additions of xenon, and heated-surface tilt out of the vertical dramatically improved poor boiling stability; additions of helium or oxygen did not. The most stable boiling was obtained when the entire heat-input area was covered by a powdered-metal coating. The effect of heated-area size was assessed for one coating: at low incident fluxes, when even this coating performed poorly, increasing the heated-area size markedly improved boiling stability. Good hot-restart behavior was not observed with any candidate, although results were significantly better with added xenon in a boiler shortened from 3 to 2 feet. In addition to the screening tests, flash-radiography imaging of metal-vapor bubbles during boiling was attempted. Contrary to the Cole-Rohsenow correlation, these bubble-size estimates did not vary with pressure; instead they were constant, consistent with the only other alkali metal measurements, but about 1/2 their size.

1420 Heat Storage

Refer also to citation(s) 32700, 32701, 32702, 32703, 32704

32719 (NEI-DK–1263) **Seasonal heat storage in large steel tanks.** Lawaetz, H. Dansk Teknologisk Inst., Taastrup (Denmark). Proevestationen for Solenergi. Mar 1993. 54p. (In Danish). Contract ENS-51181-92.0047. Order Number DE93525255. Source: OSTI; NTIS.

An investigation of costs related to traditional steel tanks used as facilities for seasonal heat storage was carried out. It was found that it would be most economical to use storage tanks 20 - 25 meters in height and with a diameter of between 25 m - 70 m where the volume is between 10,000 - 100-000 cubic meters. Prices will vary between 400 - 600 Danish kroner related to a storage capacity of 10,000 cubic meters and 300 kroner per cubic meter for a 100.000 cubic meter storage capacity. Heat loss was reckoned at 15% (tank volume: 10,000 cubic meters) and 8% (tank volume: 100,000 cubic meters.). A large steel storage tank could be built at a cost of under 300 kroner per cubic meter. A rough estimation of cost would then be 0.2 - 0.3 kroner/kWh. It is concluded that it could be economically advantageous to use a water-filled steel tank as a seasonal heat storage facility. In the long term, the cost of solar collectors and other equipment for the utilization of solar energy could be brought down to ca. 0.25 - 0.30 kroner/kWh. If the traditional price of heating becomes higher than 0.5 - 0.6 kroner/kWh, seasonal storage of solar heat in steel tanks will be found to be economically attractive. (AB)

15 GEOTHERMAL ENERGY

1501 Resources and Availability

Refer also to citation(s) 32722

32720 (NUTEK-GT–93-2) **Geothermal energy recovery from sedimentary rock.** Alm, P.G. (Lund Univ. (Sweden). Dept. of Engineering Geology); Bjelm, L.; Svensson, C. Swedish National Board for Industrial and Technical Development (NUTEK), Stockholm (Sweden); Lund Univ. (Sweden). Dept. of Engineering Geology. [1993]. 32p. (In Swedish, English). Project NUTEK-656-090. (LUTVDG-TVTG–3034). Order Number DE93795068. Source: OSTI; NTIS.

This progress report describes the prerequisities for direct utilization of geothermal energy in south-eastern Scania, and a continued follow-up of the thermodynamical processes in the Lund geothermal power plant.

1502 Geology and Hydrology of Geothermal Systems

32721 (LA-UR–93-1424) **Hydrogeochemical evaluation of conventional and hot dry rock geothermal resource potential in the Clear Lake region, California.** Goff, F.; Adams, A.I.; Trujillo, P.E.; Counce, D. Los Alamos National Lab., NM (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-931042–1: Annual meeting of the Geothermal Resources Council, San Francisco, CA (United States), 10-13 Oct 1993). Order Number DE93012670. Source: OSTI; NTIS; GPO Dep.

Chemistry, stable isotope, and tritium contents of thermal/mineral waters in the Clear Lake region were used to evaluate conventional and hot dry rock (HDR) geothermal potential for electrical generation. Thermal/mineral waters of the Clear Lake region are broadly classified as thermal meteoric and connate types based on chemical and isotopic criteria. Ratios of conservative components such as B/Cl are extremely different among all thermal/mineral waters of the Clear Lake region except for clusters of waters emerging from specific areas such as the Wilbur Springs district and the Agricultural Park area south of Mt. Konocti. In contrast ratios of conservative components in large, homogeneous geothermal reservoirs are constant. Stable isotope values of Clear Lake region waters show a mixing trend between thermal meteoric and connate (generic) end-members. The latter end-member has enriched δD as well as enriched $\delta^{18}O$, from typical high-temperature geothermal reservoir waters. Tritium data indicate most Clear Lake region waters are mixtures of old and young fluid components. Subsurface equilibration temperature of most thermal/mineral waters of the Clear Lake region is $\leq$150°C based on chemical geothermometers but it is recognized that Clear Lake region waters are not typical geothermal fluids and that they violate rules of application of many geothermometers. The combined data indicate that no large geothermal reservoir underlies the Clear Lake region and that small localized reservoirs have equilibration temperatures $\leq$150°C (except for Sulphur Bank mine). HDR technologies are probably the best way to commercially exploit the known high-temperatures existing beneath the Clear Lake region particularly within and near the main Clear Lake volcanic field.

32722 (LA-UR–93-2073) **Geothermal activity near Clearlake, California.** Burns, K.L.; Potter, R.M. Los Alamos National Lab., NM (United States). [1993]. 8p. DOE Contract W-7405-ENG-36. (CONF-931042–2: Annual meeting of the Geothermal Resources Council, San Francisco, CA (United States), 10-13 Oct 1993). Order Number DE93016627. Source: OSTI; NTIS; GPO Dep.

Geothermal activity in the region of high heat flow near the city of Clearlake includes hot springs, fumeroles, vents, and areas of hydrothermal alteration. Onshore, the location is controlled by Quaternary longitudinal NNW-trending faults of the San Andreas systems, and the transverse Burns Valley fault. Offshore, an additional control is arcuate graben-forming faults. The city is bracketed by three hydrothermal "hot spots," which are Sulphur Bank hot spring, resurgences in Burns Valley, and the Oak Cove hot spot. All three are associated with sharp "spikes" in the isotherms and locally enhanced heat flow.

1503 Geothermal Exploration and Exploration Technology

32723 (EGG-NPR–10690) **Temperatures and heat flow in INEL-GT1 and WO-2 boreholes, Snake River Plain, Idaho.** Blackwell, D.D. (Southern Methodist Univ., Dallas, TX (United States). Dept. of Geological Sciences). EG and G Idaho, Inc., Idaho Falls, ID (United States); Southern Methodist Univ., Dallas, TX (United States). Dept. of Geological Sciences. Nov 1990. 26p. Sponsored by USDOE, Washington, DC (United States). DOE

Contract AC07-76ID01570. Order Number DE93019033. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The researchers have logged temperatures in the deep geothermal test at the INEL test site on the eastern Snake River Plains in Idaho (INEL-GT1) three times over a period of 8 years. The first logging was on 8/20/82 when they reached a depth of 2100 m. They were unable to get past the casing shoe at that depth. In 1983 (7/25/83) they relogged the well with a centralizer on the temperature tool and got past the casing hanger to the end of their cable at 2870 m. In both cases the logs were made at a 0.5 m recording interval. In 1990 the researchers relogged the well for a third time and for the first time reached the bottom of the well at 3130 m. In this log the temperatures were measured at 0.2 m intervals. The temperature-depth plots for the last two logs are compared and the gradient logs for the three logs are compared. The differences in temperature are almost too small to see on the plot. The only significant differences are in the depth interval 700 to 1850 m, a section of the hole with a number of fluid disturbances.

32724 (ETDE/JP-mf–93520769) **Interim report on the 1991 research and development of the Sunshine Project.: Study on deep geothermal resource exploration technology.** Geological Survey of Japan, Tsukuba, Ibaraki (Japan). Dec 1992. 206p. (In Japanese). Order Number DE93520769. Source: OSTI; NTIS; Available from Geological Survey of Japan, 1-3, Higashi 1-chome, Tsukuba-shi, Ibaraki, Japan.

This is a report on a study of the deep geothermal resource exploration technology carried out in 1991FY as a part of the Sunshine Project. A sequential analysis of changes of production fluid chemical composition at Onuma geothermal power plant is made using a single box model hydrothermal system numerical simulator to study the development process of geothermal reservoirs by use of fluid inclusion, filling metal and HTC simulator, and forecast of reservoir-hydrothermal system variations by chemical changes of geothermal fluid. Moreover, to forecast reservoir-hydrothermal system variations by underground physical changes, the following are conducted: geothermal monitoring by observing gravity variations, GPS measurements, study of a gravity precision measuring method, water level measurement in Okuaizu area, analysis of S wave velocity structure by microtremors, etc. A series of these study results verify that such technologies are all effective as gas analysis of fluid inclusion, systematical age determination, simulation of the hydrothermal system model, and gravity variation observation. 172 refs., 106 figs., 24 tabs.

32725 (SAND–93-7028) **Preliminary study of discharge characteristics of slim holes compared to production wells in liquid-dominated geothermal reservoirs.** Pritchett, J.W. (S-Cubed, La Jolla, CA (United States)). Sandia National Labs., Albuquerque, NM (United States); S-Cubed, La Jolla, CA (United States). Jun 1993. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018445. Source: OSTI; NTIS; GPO Dep.

There is current interest in using slim holes for geothermal exploration and reservoir assessment. A major question that must be addressed is whether results from flow or injection testing of slim holes can be scaled to predict large diameter production well performance. This brief report describes a preliminary examination of this question from a purely theoretical point of view. The WELBOR computer program was used to perform a series of calculations of the steady flow of fluid up geothermal boreholes of various diameters at various discharge rates. Starting with prescribed bottomhole conditions (pressure, enthalpy), the WELBOR code integrates the equations expressing conservation of mass, momentum and energy (together with fluid constitutive properties obtained from the steam tables) upwards towards the wellhead using numerical techniques. This results in computed profiles of conditions (pressure, temperature, steam volume fraction, etc.) as functions of depth within the flowing well, and also in a forecast of wellhead conditions (pressure, temperature, enthalpy, etc.). From these results, scaling rules are developed and discussed.

32726 (SAND–93-7029) **Use of slim holes for geothermal exploration and reservoir assessment: A preliminary report on Japanese experience.** Garg, S.K. (S-Cubed, La Jolla, CA (United States)); Combs, J. Sandia National Labs., Albuquerque, NM (United States). Jun 1993. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018446. Source: OSTI; NTIS; GPO Dep.

The publicly available Japanese data on the use of slim holes in geothermal exploration and reservoir assessment are reviewed in this report. Slim holes have been used for (1) obtaining core for geological studies, (2) delineating the stratigraphic structure, (3) characterizing reservoir fluid state (pressure, temperature, etc.), and (4) defining the permeability structure for reservoir assessment. Examples of these uses of slim hole data are presented from the Hohi Geothermal Area and the Sumikawa Geothermal Field. Discharge data from slim holes and production wells from the Oguni Geothermal Field indicate that it may be possible to infer the discharge rate of production wells based on slim hole measurements. The Japanese experience suggests that slim holes can provide useful data for cost-effective geothermal reservoir assessment. Therefore, plans for a full scale evaluation of Japanese slim hole data are outlined.

1508 Geothermal Power Plants

Refer also to citation(s) 32720, 33056

32727 (LA-UR–93-2151) **Hot dry rock flow testing: What has it told us? What questions remain?.** Duchane, D.V. Los Alamos National Lab., NM (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-931042–3: Annual meeting of the Geothermal Resources Council, San Francisco, CA (United States), 10-13 Oct 1993). Order Number DE93016613. Source: OSTI; NTIS; GPO Dep.

Flow testing at a pilot facility at Fenton Hill, NM has begun to provide answers to important questions about the practicality of extracting geothermal energy from hot dry rock (HDR). The plant was operated for continuous periods of up to 112 days with no drop in the temperature of water produced from an artificial geothermal reservoir and, in fact, evidence of increasing fluid access to hot rock as the test proceeded. Water consumption was shown to decline with time to the lowest levels ever achieved in HDR flow testing. Costs of pumping water through the HDR system were documented for the first time and the generation of excess energy was demonstrated. Geochemical results indicated low levels of dissolved solids and gases with no emissions to the environment during normal operations. Several issues regarding the construction and operation of HDR geothermal plants remain to be resolved. The long-term sustainability of the resource has not yet been unambiguously demonstrated. Many costs related to construction, operation and maintenance of HDR plants have yet been adequately addressed. Because so few HDR reservoir have been created, there is as yet limited confidence in the geographical and geological versatility of the technology. Nevertheless, substantial progress has recently been made toward showing that HDR can be an efficient source of clean energy.

1509 Geothermal Engineering

Refer also to citation(s) 32727

32728 (DOE/CE–17712) **Geothermal Chemical Modeling Project DOE Advanced Brine Chemistry Program.** Moeller, N.; Weare, J.H. California Univ., San Diego, La Jolla, CA (United States). Apr 1993. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-88SF17712. Order Number DE93016763. Source: OSTI; NTIS; GPO Dep.

The brine-calcite-anhydrite-silica scale model program is ready to be used by the industry at a research level. Versions are already in use in studies of scaling in geothermal and oil production systems. A set of short course notes has been prepared to help perspective users. IBM and Macintosh versions of the model are available. The gas phase models have been incorporated in the general package for distribution. Both mainframe (SUN) and PC versions (MacIntosh and IBM) of the code have been distributed.

32729 (LA-UR–93-2183) **A potential for enhanced energy production by periodic pressure stimulation of the production**

well in an HDR reservoir. DuTeau, R. Los Alamos National Lab., NM (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-931042–4: Annual meeting of the Geothermal Resources Council, San Francisco, CA (United States), 10-13 Oct 1993). Order Number DE93016603. Source: OSTI; NTIS; GPO Dep.

The results obtained by briefly shutting off flow to induce a periodic pressure rise in the production well of an HDR (Hot Dry Rock) system indicates the thermal power production of a reservoir can be enhanced by this cyclic mode of operation. An experiment designed to test this hypothesis of enhanced energy production was executed at Fenton Hill, in New Mexico. The experiment was conducted by closing the production wellhead valve for a 25 minute interval at a standard time on each of three consecutive days during a flow test that had previously been operating at nearly steady state with continuous injection and production. The pressure rise resulting from temporarily halting the production flow caused an increase in the subsequent flow rate after reopening the wellhead valve each day. The enhanced flow more than compensated for the production lost during the daily wellhead shut-in and the rate of flow remained at an elevated level 24 hours later. Consequently, the rate of thermal energy production increased as compared to the thermal power production during continuous circulation, and the integrated quantity of energy removed from the reservoir on a daily basis also increased. In addition, the rate of production flow demonstrated a hysteretic effect resulting in more total production from the reservoir on each consecutive day of periodic pressure stimulation. Thus, the total energy production from the reservoir increased on consecutive days dining the experiment. These results show the potential value for further cyclic-mode evaluation of HDR reservoirs.

32730 (LBL–32907) **Supplement to wellbore models GWELL, GWNACL, and HOLA User's Guide.** Hadgu, T.; Bodvarsson, G.S. Lawrence Berkeley Lab., CA (United States). Sep 1992. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93015291. Source: OSTI; NTIS; GPO Dep.

A study was made on improving the applicability and ease of usage of the wellbore simulators HOLA, GWELL and GWNACL (Bjornsson, 1987; Aunzo et al., 1991). The study concentrated mainly on the usage of Option 2 (please refer to the User's Guide; Aunzo et al., 1991) and modeling flow of superheated steam when using these computer codes. Amendments were made to the simulators to allow implementation of a variety of input data. A wide range of input data was used to test the modifications to the codes. The study did not attempt to modify or improve the physics or formulations which were used in the models. It showed that a careful check of the input data is required. This report addresses these two areas of interest: usage of Option 2, and simulation of wellbore flow of superheated steam.

1510 Direct Energy Utilization

Refer also to citation(s) 32720

1520 Geothermal Data and Theory

Refer also to citation(s) 32728

1540 Waste Management

32731 (BNL–48458) **Recent developments in geothermal waste treatment biotechnology.** Premuzic, E.T.; Lin, M.S.; Jin, J.Z. Brookhaven National Lab., Upton, NY (United States). May 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9309108–1: 9. international conference on heavy metals in the environment, Toronto (Canada), 12-17 Sep 1993). Order Number DE93018823. Source: OSTI; NTIS; INIS; GPO Dep.

Continuing studies at Brookhaven National Laboratory (BNL) have shown that cost-efficient biotechnology for the removal of toxic trace metals from geothermal sludge is feasible. Pilot-scale experiments have shown that fast rates (< 24-h) of metal removal at 55°C–60°C can be achieved with removal efficiencies of better than 80%, yielding a product well within the environmental regulatory limits. Recent studies have shown that radionuclides, such as radium present in low concentrations in some sludges, can also be removed by means of a secondary biotreatment. The process produces an aqueous phase which contains all of the regulatory metals in a soluble form. A follow-up technology for the treatment of the aqueous phase is concurrently being developed at BNL. Preliminary results indicate that a small volume concentrate of metals can be generated producing an aqueous phase which meets drinking water standards. In this paper the current state-of-the-biotechnology will be discussed.

16 TIDAL AND WAVE POWER

1605 Environmental Aspects

32732 (ETSU-TID–4112) **In situ erosion of cohesive sediment.** Williamson, H.J.; Ockenden, M.C. Hydraulics Research Ltd., Wallingford (United Kingdom). 1993. 88p. Order Number DE93515075. Source: OSTI; NTIS (US Sales Only); INIS.

There has been increasing interest in tidal power schemes and the effect of a tidal energy barrage on the environment. A large man-made environmental change, such as a barrage, would be expected to have significant effects on the sediment distribution and stability of an estuary and these effects need to be assessed when considering a tidal barrage project. This report describes the development of apparatus for in-situ measurements of cohesive sediment erosion on inter-tidal mudflats. Development of the prototype field erosion bell and field testing was commissioned on behalf of the Department of Trade and Industry by the Energy Technology Support Unit (ETSU). This later work commenced in August 1991 and was completed in September 1992. (Author)

1608 Wave Energy Converters

32733 (ETSU-R–72) **A review of wave energy. V. 1: Main report.** Thorpe, T.W. AEA Environment and Energy, Harwell (United Kingdom). Dec 1992. 172p. Order Number DE93798223. Source: OSTI; NTIS (US Sales Only).

Final report.

This report provides a comprehensive review of four of the major UK offshore wave energy design proposals, and one shoreline device, evaluated as part of the review. These cover a representative selection of device principles and locations. Three other devices have been evaluated, but in less depth, to assess some recent developments. The major designs considered were: the Edinburgh Duck, the Coventry Clam, the Bristol Cylinder, the NEL Breakwater and the QUB shoreline device. The report provides two important sets of findings. The first is the estimates of the potential generating costs of the different devices. The second is the components of R and D that must be successfully completed if these generating costs are to be achieved. In many ways the lists of R and D are a good reflection of the distance of the devices from deployment. (author)

17 WIND ENERGY

32734 (DOE/FTR–93015325) **Travel to United Kingdom and Sweden to attend meeting concerning the development of wind energy systems: Foreign trip report, May 2–9, 1993.** Carlin, P.W. National Renewable Energy Lab., Golden, CO (United States). 14 Jun 1993. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE93015325. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The thirty-first meeting of the IEA R&D Executive Committee was held in the Gibraltar Conference Center of Chalmers University in Goeteborg, Sweden. Nineteen persons from nine counties were present at the meeting. Those who were the members of the Executive Committee reported progress in wind energy implementation in their respective counties since the previous EC meeting. Operating agents reported on their respective Annexes, and the

Newsletter Editor presented the material for the next Newsletter. After the formal meeting a group visit was made to the Chalmers University Wind Test Station on Hano island where tests are being made on a 40 kW, variable speed machine and its power electronics hardware. A second visit was made to the Lyse Wind Power Station where a new 400 kW, 2 bladed, teetered NWP machine is being compared against a 3 bladed commercial Bonus machine. On the last day a visit was made to the 2 MW Naesudden 11 machine on Gotland Island. This machine uses a special sled which traverses a track up the side of the tower to lift the nacelle to is operating position.

1701 Resources and Availability (Climatology)

Refer also to citation(s) 33787

32735 (PNL-SA–22090) **Seasonal variability of wind electric potential in the United States.** Schwartz, M.N.; Elliott, D.L.; Gower, G.L. Pacific Northwest Lab., Richland, WA (United States). Jul 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930726–4: Windpower '93, San Francisco, CA (United States), 12-16 Jul 1993). Order Number DE93018182. Source: OSTI; NTIS; GPO Dep.

Seasonal wind electric potential has been estimated for the contiguous United States based on the methods previously used to estimate the annual average wind electric potential. National maps show estimates of the seasonal wind electric potential averaged over the state as a whole, and gridded maps show the distribution of the seasonal wind electric potential within a state. The seasons of winter and spring have highest wind electric potential for most windy areas in the United States. Summer is the season with the least potential for most of the contiguous United States. Wind electric potential patterns in autumn generally resemble the annual average potential map. Excellent matches between seasonal wind electric potential and electric energy use occur during winter for the northern parts of the nation. California has a good match between summer wind potential and electric use.

1704 Economic, Industrial, and Business Aspects

32736 (ENEA-RTI-ENE-FORI–92-01) **Danish wind turbines: Technical-economic feasibility of commercial models.** Falchetta, M. (ENEA, Camugnano (Italy). Centro Ricerche Energia Brasimone). 1992. 21p. (In Italian). Contract E-FQ-I-92001. Order Number DE93522996. Source: OSTI; NTIS (US Sales Only); INIS.

This feasibility study examines the principal technical and economic (investment-manufacturing-installation-operation unit costs, supply and demand) characteristics of wind turbines being commercialized in Denmark. The general configuration of the 150 to 450 kW range machines currently being manufactured can be described as that of a three bladed fibreglass rotor, of from 24 to 35 meters in diameter, and mounted on a tower of from 29 to 41 meters in height. The electrical system consists of one asynchronous generator or a two generator system with a power ratio of 1 to 5 between the two generators. The cost analysis reveals that the Danish wind turbines are competitively priced, with per kWh costs varying from $0. 0675 to $0. 040 for operating wind speeds ranging from 5 to 7 m/sec, and that their overall design and performance characteristics make them suitable for Italian site conditions.

1706 Wind Energy Engineering

Refer also to citation(s) 32964

32737 (AUC-IBT-R–9318) **Fatigue tests on laminated wooden beams: Partial report 13. Comparisons, evaluations and conclusions.** Pilegaard Hansen, L.; Rathkjen, A. Aalborg Universitetscenter (Denmark). Inst. for Bygningsteknik. Jun 1993. 26p. (In Danish). Contract TR-88.1040;Contract ENS-51171-91.0004. Order Number DE93525271. Source: OSTI; NTIS.

The fatigue characteristics of laminated wooden beams were examined in a series of tests during the period 1987-1991. Comparisons, evaluations and conclusions in relation to all the results of these measurements are presented in this report. In beams where fibres are parallel to the axle the two forms of fracture are compression fracture and cracks parallel with the fibers - at an equal ratio - whereas the form of fracture where cracks are parallel with the fibres are absolutely dominating in non-reinforced beams with diagonal fibres. In the case of beams with diagonal fibres reinforced with 5 mm lamella on the tension side the compression fracture appears in beams with 1:20 fiber slant whilst the cracks parallel with fibers dominate in relation to other types. (AB) (15 refs.)

32738 (DOE/FTR–93013880) **Travel to Denmark and Switzerland concerning safety codes at wind turbine test facilities: Foreign trip report, April 27–May 5, 1993.** Kelley, N.D. National Renewable Energy Lab., Golden, CO (United States). 21 May 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE93013880. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This meeting was held in Denmark on April 29–30, 1993. The Chair representing the IEA was B. Maribo Pedersen of the Technical University of Denmark and the local host was Sten Fransen of the Riso Test Station for Wind Turbines. The subject of the meeting was to discuss participant experiences in describing the characteristics of the natural wind and to compare them with the wind specifications contained within the IEC Draft Document TC-88, "Safety of Wind Turbine Generator Systems." The meeting format consisted of individual participant presentations followed by a round table discussion of the issues raised individually and those suggested by host Sten Fransen.

32739 (DOE/FTR–93016248) **Travel to Italy to participate in the International Electrotechnical Committee TC-88 Working Group 6 Performance Standards Meeting: Foreign trip report, May 23–May 27, 1993.** Smith, B. National Renewable Energy Lab., Golden, CO (United States). 24 Jun 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE93016248. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The International Electrotechnical Committee TC-88 Working Group 6 Performance Standards Meeting was held on May 25 & 26, 1993 and hosted by Gabriele Botta of the Electrical Research Center (ENEL-CREL) in Milan, Italy. The two-day meeting was the fourth in a series of meetings directed at the development of an international power performance measurement procedure for wind turbine generator systems. At this meeting, the technical committee reviewed and revised the contents of working draft 5 of the power performance document and incorporated the revisions into working draft 6. Four main topics were discussed, as follows: Comments to working draft 5: Key issues needing discussion to reach WG 6 consensus, Assessment of test site: Assess site terrain for sources of wind flow distorsion, Calibration of test site: Procedure for determining site calibration factors, Database: Quantity of data to be collected. Each issue was discussed at length and the resulting agreements are being incorporated into working draft 7 by the committee convener, Troels Friis Pedersen of Riso National Laboratory. The fifth TC-88 Working Group 6 meeting is scheduled for September 9–10, 1993 and will be hosted by Stephen Glocker of WINDTEST Kaiser-Wilhelm-Koog in Hamburg, Germany.

32740 (ECN-I–93-028) **Status of PHATAS-2 release 'Jul-93'.** Lindenburg, C. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Aug 1993. 25p. Project NOVEM 24.710/5000;Project ECN 4208. Order Number DE93524589. Source: OSTI; NTIS; Available from the library of the Netherlands Energy Research Foundation (ECN), P.O. Box 1, 1755 ZG Petten (Netherlands).

Release 'JUL-93' of the computer program PHATAS-2 replaces the previous release 'DEC-92'.

A description is given of the status of release 'JUL-93' of the computer program PHATAS-2 and its postprocessor of which the executables have the name 'phatas793' and 'phpost793'. It includes the specifications of the code, a listing of the appropriate documentation, the specifications of the required hardware and an installation guide. PHATAS-2 can be used for the calculation of rotor characteristics and dynamic behavior of wind turbines. 16 figs., 5 tabs., 8 refs.

32741 (ECN-R--93-006) **Profile calculations with the airfoil design code XFOIL.** Brand, A.J. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Jul 1993. 35p. (In Dutch). Project ECN 4247.01. Order Number DE93524599. Source: OSTI; NTIS; Available from the library of the Netherlands Energy Research Foundation (ECN), P.O. Box 1, 1755 ZG Petten (Netherlands).

Research was carried out during the third and fourth quarter of 1992 within the framework of the project 'Orientation Computational Fluid Dynamics software'.

The performance of the airfoil (re)design code XFOIL is evaluated by comparing computed and measured aerodynamic coefficients for the NACA4412, NACA4415 and NACA23015 airfoils for Reynolds numbers smaller than 3.10^6. It is found that the computed lift coefficients and stall angles are too large, and the computed drag coefficients are too small. Furthermore, the potential of XFOIL to describe the effect of profile deviations is investigated by considering two modified NACA4415 airfoils. 18 figs., 4 tabs., 4 refs.

32742 (ECN-RX--93-086) **Reliability analysis for the load-carrying parts of horizontal axis wind turbines.** Van den Horn, B.A.; Rademakers, L.W.M.M. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Aug 1993. 5p. Order Number DE93524588. Source: OSTI; NTIS; Available from the library of the Netherlands Energy Research Foundation (ECN), P.O. Box 1, 1755 ZG Petten (Netherlands).

Paper resented at the 6th International Conference on Structural Safety and Reliability ICOSSAR'93, 9-13 August 1993.

Presently, wind turbines are being designed in accordance with deterministic design rules. These rules concern the design of main components and the safety systems. They neither facilitate the quantification of the degree of conservatism in the applied safety margins nor explicitly address the reliability and availability of the wind turbine. By a case study of the Lagerwey LW 15/75 wind turbine design, it has been demonstrated that the wind turbine industry can take advantage of the safety and reliability practices applied in e.g. aerospace, nuclear and offshore industry. Qualitative methods for System Reliability, such as a Thorough System Description, State Diagram, Failure Mode, Effect, and Criticality Analysis (FMECA), Event Tree and Fault Tree Analysis, can be implemented immediatly in the design process of wind turbines. Quantitative analysis methods can be applied during the useful life period, where failures are random. System reliability is a strong and systematical method to improve and assess the safety and reliability of a wind turbine and to feedback operational experience. To reduce the early failures which are quite often the result of unknown phenomena during rare events, load measurement programmes and operation monitoring must be performed during the burn-in period of a wind turbine. The collection of data for the LW 15/75 turbines under study has shown limitations in the current practice. Not all types of data required for reliability purposes were recorded. Despite of the shortcomings of data collection, both qualitative and quantitative information has been derived from the available operational experience. This information is helpful to plan and optimize maintenance and inspection procedures. Recommendations are given to improve data collection and analysis possibly by means of a computerized system. The feasibility and applicability of Structural Reliability in wind turbine engineering has been demonstrated.

32743 (ECN-RX--93-087) **PHATAS-2: Program for Horizontal Axis wind Turbine Analysis and Simulation Version 2.** Lindenburg, C.; Snel, H. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Aug 1993. 6p. Order Number DE93524597. Source: OSTI; NTIS; Available from the library of the Netherlands Energy Research Foundation (ECN), P.O. Box 1, 1755 ZG Petten (Netherlands).

Paper presented at the twelfth ASME Wind Energy Symposium, held at January 31 - February 4, 1993, Houston, Texas (US).

A description of the title program, developed at the unit Renewable Energies of the Netherlands Energy Research Foundation in Petten, Netherlands, is given. PHATAS-2 is an analysis tool for the calculation of the behavior and loads of horizontal axis wind turbines. The theoretical background is outlined by a brief discussion of some aspects of modelling structural dynamics, aerodynamics and the applied solution technique. Examples to demonstrate the possible applications of PHATAS-2 are given, some of which are dealing with the latest developments of the program. From intensive use for design and research purposes and from successful participation in some benchmark exercises, PHATAS-2 evolved as a powerful and reliable design tool. During further developments, the lasting quality of PHATAS-2 is being assured by a formal test procedure. 13 figs., 11 refs.

32744 (ECN-RX--93-088) **Comparison of wind turbine structural design according to Dutch standard and draft IEC TC88 standard.** Van Hulle, F. (Unit ECN Renewable Energies, Netherlands Energy Research Foundation, Petten (Netherlands)); Winkelaar, D.; Wiersma, H. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Aug 1993. 12p. Order Number DE93524598. Source: OSTI; NTIS; Available from the library of the Netherlands Energy Research Foundation (ECN), P.O. Box 1, 1755 ZG Petten (Netherlands).

Paper presented at the IEA Topical Expert Meeting 24 on Wind Conditions for Wind Turbine Design, Risoe, Denmark, April 29-30, 1993.

The title comparison was carried out to check the consequences of imposing the draft IEC TC88 standard for the structural design of wind turbines, designed according to the Dutch standard. The comparison, which was made on the level of required cross sectional area of structural members, concerns three types of (commercial) wind turbines from Dutch manufacturers. The study deals with wind modelling and structural design. In the present paper the most important findings of this study are presented. Also some ideas about requirements with respect to stochastic wind simulation are discussed. 8 figs., 7 tabs., 9 refs.

32745 (NREL/TP--442-5617) **A rugged, low-cost advanced data acquisition system for field test projects.** Simms, D.A. (National Renewable Energy Lab., Golden, CO (United States)); Cousineau, K.L.. National Renewable Energy Lab., Golden, CO (United States). Jun 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. (CONF-9310131--1: 29. annual international telemetering conference, Las Vegas, NV (United States), 25-28 Oct 1993). Order Number DE93010041. Source: OSTI; NTIS; GPO Dep.

The National Renewable Energy Laboratory (NREL) has teamed up with Zond Systems, Inc., to provide a rugged, low-cost, advanced data-acquisition system (ADAS) for use in field test projects. The ADAS simplifies the process of making accurate measurements on mechanical equipment exposed to harsh environments. It provides synchronized, time-series measurement data from multiple, independent sources. The ADAS is currently being used to acquire data from large wind turbines in operational windplant environments. ADAS modules are mounted on rotating blades, turbine towers, nacelles, control modules, meteorological towers, and electrical stations. The ADAS has the potential to meet the testing and monitoring needs of many other technologies as well, including vehicles, heavy equipment, piping and power transmission networks, and building energy systems.

32746 (RISO-R--691(EN)) **Response of stall regulated wind turbines: Stall induced vibrations.** Rasmussen, F. (Risoe National Lab. (Denmark)); Thirstrup Petersen, J.; Winkelaar, D.; Rawlinson-Smith, R. Risoe National Lab., Roskilde (Denmark). Test Station for Wind Turbines. Jun 1993. 343p. Contract ENS-1364/91-0001;Contract ENS-1364/91-0002;Contract ENS Order Number DE93516675. Source: OSTI; NTIS; Also available from Risoe Library, P.O. Box 49, DK-4000 Roskilde, Denmark.

EFP-91; EFP-93.

The fear that large stall regulated wind turbines may suffer from stall induced vibrations has to some extent hindered the development of large stall controlled HAWTs. The dynamic behaviour of wind turbine rotor blades in stall has been investigated in order to clarify the importance of stall induced vibrations, identify the physical phenomena involved and to set up design guidelines for the next generation of larger and possibly more flexible stall regulated wind turbines. The work programme involved coordinated measurement and theoretical modelling of four stall regulated turbines ranging in size from 21 m to 40 m diameter. The stalling process

was examined in terms of quasi-static and unsteady inflow. The quasi-static modal damping coefficient was identified as an important parameter in determing a rotor's susceptibility to stall induced vibrations. However, the use of quasi-static aerodynamics in wind turbine aeroelastic codes was shown to be deficient when calculating stalled rotor dynamic performance. The inclusion of unsteady aerodynamic models within the aeroelastic codes was found to considerably improve the agreement between measured and predicted dynamic behaviour of stalled rotors. A parametric study was performed to determine the sensitivity of the modal damping coefficient to blade parameters. Specifically the effect of scale was investigated. It was found that with the exception of the effects of Reynolds' number the susceptibility of structurally similar rotors to stall induced vibrations should not increase with size. A procedure for designing a stall regulated rotor was defined which allows the likelihood of a new rotor's susceptibility to stall induced vibrations to be assessed. (au) (32 tabs., 211 ills., 66 refs.)

32747 (SAND–93-0391C) **Optimizing wind turbine control system parameters.** Schluter, L.L. (Sandia National Labs., Albuquerque, NM (United States)); Vachon, W.A. Sandia National Labs., Albuquerque, NM (United States). 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930726–5: Windpower '93, San Francisco, CA (United States), 12-16 Jul 1993). Order Number DE93018861. Source: OSTI; NTIS; GPO Dep.

The impending expiration of the levelized period in the Interim Standard Offer Number 4 (ISO4) utility contracts for purchasing wind-generated power in California mandates, more than ever, that windplants be operated in a cost-effective manner. Operating plans and approaches are needed that maximize the net revenue from wind parks–after accounting for operation and maintenance costs. This paper describes a design tool that makes it possible to tailor a control system of a wind turbine (WT) to maximize energy production while minimizing the financial consequences of fatigue damage to key structural components. Plans for code enhancements to include expert systems and fuzzy logic are discussed, and typical results are presented in which the code is applied to study the controls of a generic Danish 15-m horizontal axis wind turbine (HAWT).

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Refer also to citation(s) 32170, 32223, 32667, 32672, 32802, 32969, 33115, 33422

32748 (ANL/EP/CP–79808) **Technical support for combustion 2000 program.** Ahluwalia, R.K.; Im, K.H.; Natesan, K.; Livengood, C.D.; Schmalzer, D.K. Argonne National Lab., IL (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930787–4: 9. annual coal preparation, utilization, and environmental control contractors' conference, Pittsburgh, PA (United States), 19-22 Jul 1993). Order Number DE93017737. Source: OSTI; NTIS; GPO Dep.

The high-temperature advanced furnace (HITAF) is an important component of the high-performance power system (HIPPS) being developed in the Combustion 2000 program. The purpose of HITAF is to raise superheated steam for the Rankin cycle and to heat the clean working fluid (air) to 1,800-2,400°F for the Brayton cycle. Analytical and experimental investigations are being carried out to design, analyze and assess different concepts for high temperature advanced furnaces capable of heating compressed air to 1,800-2,400°F; to evaluate performance of metallic and ceramic materials for service at elevated temperatures in HITAF environment; and to conduct critical, systems-oriented evaluations of advanced flue-gas cleanup (FGC) technologies appropriate to the low-emission-boiler systems (LEBS).

32749 (DOE/FE–0279) **Report to Congress: Comprehensive Program Plan for Advanced Turbine Systems.** USDOE Assistant Secretary for Fossil Energy, Washington, DC (United States); USDOE Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC (United States). Jul 1993. 51p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93016718. Source: OSTI; NTIS; GPO Dep.

Consistent with the Department of Energy (DOE) mission, the Advanced Turbine Systems (ATS) Program will develop more efficient gas turbine systems for both utility and industrial electric power generation (including cogeneration). The Program will develop base-load power systems for commercial offering in the year 2000. Although the target fuel is natural gas, the ATS will be adaptable to coal and biomass firing. All ATS will exhibit these characteristics: Ultra-high efficiency [utility systems: 60 percent (lower heating value basis); industrial systems: 15 percent improvement over today's best gas turbine systems]; Environmental superiority [reduced nitrogen oxides (NO_x), carbon dioxide (CO_2), carbon monoxide (CO), and unburned hydrocarbons (UHC)]; and Cost competitiveness [10 percent lower cost of electricity]. This Program Plan was requested in the House, Senate, and Conference Reports on the FY 1993 Interior and Related Agencies Appropriations Act, Public Law 102–381, and is consistent with the Energy Policy Act of 1992, which (in Section 2112) identifies work for improving gas turbines. This plan outlines the 8-year ATS Program and discusses rationale and planning. Total Program costs are estimated to be $700 million, consisting of an approximate $450 million government share and an approximate $250 million cost-share by industrial participants.

32750 (DOE/FTR–93017251) **Travel to India as representatives of TVA concerning programs on thermal power plants: Foreign trip report, March 7–18, 1992.** Daugherty, E.D. (Tennessee Valley Authority, (United States)); Huang, Chao-Ming. USDOE Pittsburgh Energy Technology Center, PA (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93017251. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This effort was undertaken at the request of the DOE/PETC as part of the Alternate Energy Resources Development (AERD) program sponsored by USAID and the Government of India (GOI). The overall coordination of the program is being provided by PETC with the assistance of Oak Ridge National Laboratory (ORNL) After numerous discussions and deliberations, a preliminary draft of the work statement for "Model Studies for Coal-Fired Power Plant Condition Assessment and Remaining Life Estimations under the recently initiated USAID/GOI EMCAT program was completed. This document outlines the objectives, overall approach, suggested participating organizations, implementation strategies, specific tasks, project schedule, budget requirements, and benefits to all participants. Two model studies specifically aimed at developing and establishing the domestic capability of India in condition assessment and life extension of power plants are being proposed under EMCAT. A preliminary approach for technical assistance by TVA on the OLDMS was also tentatively agreed to by TVA and PFC.

32751 (DOE/FTR–93017869) **Travel to England to present paper of DOE 2nd-Generation PFB Project Conference and visit British Coal Test facilities at Stoke Orchard and Grimethorpe: Foreign trip report, December 8–14, 1991.** Robertson, A.S. Foster Wheeler Development Corp., Livingston, NJ (United States). 3 Feb 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-86MC21023. Order Number DE93017869. Source: OSTI; NTIS (US Sales Only); GPO Dep.

British Coal is pursuing the development of a second- generation/advanced PFB cycle called the British Coal Topping Cycle that (a) Operates the topping combustor fuel gas generating unit/gasifier at 1742 to 1802°F (950 to 1000°C) to maximize gas yields and heating values without getting into agglomeration or sulfur-capture problems. (b) Cools the fuel gas to 1112°F (600°C) to condense/eliminate alkali risks and simplify the design of the ceramic barrier filter (candles) that protects the gas turbine. (3) The gasifier residue is cooled and depressured to permit its combustion in an atmospheric CFB. Since the CFB flue gas exhausts to atmosphere, the topping combustor is cooled with compressor discharge at ~700°F (371°C) rather then with 1600°F (871°C) CFB flue gas.

32752 (DOE/MC/29444–3403) **Toms Creek Integrated Gasification Combined Cycle Demonstration Project: Final**

quarterly technical progress report for the period ending March 31, 1993. Feher, G. Tampella Power Corp., Williamsport, PA (United States). 24 May 1993. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC21-93MC29444. Order Number DE93019999. Source: OSTI; NTIS; GPO Dep.

This Quarterly Technical Progress Report for the period ending March 31, 1993 summarizes the work done to data by Tampella Power Corporation and Enviropower, Inc. on the integrated combined-cycle power plant project. Efforts were concentrated on the Toms Creek PDS (Preliminary Design and Studies). Tampella Power Corporation's efforts were concentrated on the Toms Creek Preliminary Process Flow Diagram (PFD) and Piping and Instrument Diagrams (P&IDs). Tampella Power Corporation also prepared Heat and Material Balances (H&MBs) for different site-specific cases.

32753 (DOE/PC/30071–T7) **Evaluation of dense-phase ultrafine coal (DUC) as a fuel alternative for oil- and gas-designed boilers and heaters: Final report.** Mitre Corp., McLean, VA (United States). METREK Div.; Burns and Roe, Inc., Oradell, NJ (United States). Dec 1986. 235p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-80PC30071. Order Number DE93040676. Source: OSTI; NTIS; GPO Dep.

Utility and industrial firms currently using oil- and gas-fired boilers have an interest in substitution of coal for oil and gas as the primary boiler fuel. This interest stems from coal's two main advantages over oil and gas-lower cost and security of supply. Recent efforts in the area of coal conversion have been directed to converting oil- and gas- fired boilers which were originally designed for coal-firing or were designed with some coal-firing capability. Boilers designed exclusively for oil- or gas-firing have not been considered viable candidates for coal conversion because they generally require a significant capacity derating and extensive and costly modifications. As a result, conversion of boilers in this class to coal-firing has generally been considered unattractive. Renewed interest in the prospects for converting boilers designed exclusively for oil- and gas-firing to coal firing has centered around the concept of using "ultra fine" coal as opposed to "conventional grind" pulverized coal. The main distinction being the finer particle size to which the former is ground. This fuel type may have characteristics which ameliorate many of the boiler problems normally associated with pulverized coal-firing. The overall concept for ultrafine coal utilization is based on a regional large preparation plant with distribution of a ready to fire fuel directly to many small users. This differs from normal practice in which final coal sizing is performed in pulverizers at the user's site.

32754 (DOE/PC/91154–T5) **Development of a high-performance coal-fired power generating system with pyrolysis gas and char-fired high temperature furnace (HITAF): Quarterly progress report No. 5, January–March 1993.** Foster Wheeler Development Corp., Livingston, NJ (United States). May 1993. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-91PC91154. Order Number DE93019785. Source: OSTI; NTIS; GPO Dep.

A concept for an advanced coal-fired combined-cycle power generating system is currently being developed. Goals have been specified that relate to the efficiency, emissions, costs, and general operation of the system. (1) Total station efficiency of at least 47 percent. (2) No more than: 0.15 lb NO_x or 0.15 lb SO_x or 0.0075 lb of particulates/10^6 Btu fuel heat input. (3) All solid wastes must be benign. (4) Over 95 percent of the total heat input is ultimately from coal, with initial systems capable of using coal for at least 65 percent of the heat input. (5) Efficient and economic baseload power generation: Operation with a range of US coals, annual capacity factor of 65 percent, and load following with minimal degradation in efficiency. (6) 10-percent lower cost of electricity relative to a modern coal-fired plant conforming to NSPS. (7) Safety, reliability, and maintainability to meet or exceed conventional coal-fired power plants. (8) Amenable to construction using factory-assembled modular components based upon standard design. The system proposed to meet these goals is a combined-cycle system where air for a gas turbine is indirectly heated to approximately 1800°F in furnaces fired with coal-derived fuels and then directly heated in a natural-gas-fired combustor to about 2400°F. The system is based on a pyrolyzing process that converts the coal into a low-Btu fuel gas and char. The fuel gas is relatively clean, and it is fired to heat tube surfaces that are susceptible to corrosion and problems from ash deposition. In particular, the high-temperature air heater tubes, which will need to be a ceramic material, will be located in a separate furnace or region of a furnace that is exposed to combustion products from the low-Btu fuel gas only.

32755 (LA-SUB–93-237-Vol.1) **TA-16 steam plant evaluation: Volume 1: Final report.** Los Alamos National Lab., NM (United States); Stone and Webster Engineering Corp., Denver, CO (United States). Nov 1992. 87p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93018280. Source: OSTI; NTIS; GPO Dep.

The TA-16 steam plant has provided reliable service for over 40 years through a combination of conservative, redundant design and continuous operations and maintenance attention. However, continued aging of plant components, particularly controls and electrical, have raised concerns about continued safety and reliability. Rising fuel prices have also increased concerns with efficiency. This study investigated the current condition of all plant components and considered several options to improve the safety, reliability and efficiency of the TA-16 steam plant. A summary of options and their estimated installed costs is given. Options are compared on the basis of several types of savings. Details of the contents of each modification option are provided in this report. The inspection program is recommended even if no other modifications are implemented.

32756 **Integrated three source electric power generation.** Richardson, R.D. 2 Sep 1992. Filed date 1 Mar 1991. Canada patent application 2037382. 51p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

A process is provided in which a magnetohydrodynamic (MHD) channel for production of electric power is uniquely integrated with the combined cycle production of other electric power by gas and steam turbines to provide three co-current productions of power, each by different means and apparatus, but all as part of one synergistic electric power generation system. An important feature of the 3-source system is its overall heat management including the double-duty use of high temperatures momentarily reached in coal or heavy oil gasification, as in the preferred embodiment of the invention, or in an alternative system where light oil or natural gas is combusted in a gas turbine as part of a combined cycle system involving also steam power production, with superheated hot air being used to bring MHD plasma to the desired high temperature level for efficient electric power output. High temperature hot air may also be used beneficially to boost MHD plasma temperature to provide an increase in electric power produced when it is applied in its preferred embodiment to a coal or heavy oil fuelled gasification combined cycle system as a supplementary momentary high temperature heat source. With efficient heat recovery management, the 3-source system of the invention can expect to produce electric power at a thermal efficiency in excess of 60%. 6 figs.

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Refer also to citation(s) 32198, 32202, 32204, 32217, 32221, 32223, 32230, 32231, 32671, 32752

32757 (ANL/ES/CP–80346) **Technologies for CO_2-capture from advanced power-generation systems.** Wolsky, A.M.; Daniels, E.J.; Jody, B.J. Argonne National Lab., IL (United States). Jun 1993. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38 ;FG02-92ER30194. (CONF-9308137–3: 1993 summer national American Institute of Chemical Engineers (AIChE) conference, Seattle, WA (United States), 15-18 Aug 1993). Order Number DE93019006. Source: OSTI; NTIS; GPO Dep.

The US power-generation industry generated about 1.5 billion metric tons of CO_2 in 1990, with over 95% of that CO_2 being generated by coal-fired utility boilers. Extensive use of coal for power

generation is expected to continue for many years to come. Therefore, should capture and sequestration of CO_2 be necessary, coal-fired power plants are likely to be primary targets for CO_2 capture. This paper discusses opportunities and techniques for the capture of CO_2 from the advanced power-generation systems that appear to be the leading candidates for widespread commercialization in the next two decades: integrated coal gasification-combined cycle (IGCC) and fuel cells. Retrofitting of conventional power plants for burning coal with O_2 to facilitate CO_2 capture was also investigated. A brief discussion of the impact of the CO_2-capture technology on the cost of power generation is also presented. Research and development needs of the CO_2-capture technologies are also identified. The results indicate that CO_2 recovery from IGCC and fuel-cell plants is less complicated, less energy-intensive, and less costly than its recovery from conventional coal-fired power stations.

32758 (DOE/PC/81004–T5) **Proof-of-concept testing of fluidized-bed copper oxide process: Phase 4, conceptual design and economic evaluation: Technical progress report No. 4-4, October 1992–March 1993.** UOP, Inc., Des Plaines, IL (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-85PC81004. Order Number DE93040707. Source: OSTI; NTIS; GPO Dep.

The objective of Phase IV of the contract is to design a conceptual flue gas treating unit based on the fluidized-bed Copper Oxide (FBCO) process for a new coal-fired 500 MW(e) power plant. A technical and economic evaluation of the FBCO process, based on the conceptual design, will also be completed. Progress is described.

32759 (DOE/PC/88858–T10) **Surface study of absorbents for the removal of SO_x and NO_x: [First quarterly report, March 1–May 31, 1988].** Cooper, B.R.; Montano, P.A. West Virginia Univ., Morgantown, WV (United States). Dept. of Physics. [1988]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-88PC88858. Order Number DE93019441. Source: OSTI; NTIS; GPO Dep.

The objective of this program is to obtain an understanding of the crystallographic and electronic structure of the active sites on supported oxides which are used in the removal of $S0_2$ and NO_x from flue gases. This understanding will be used to help in the development of new metal oxide sorbents with enhanced effectiveness towards the removal of deleterious gases from combustion products. Such successful sorbent development will further the goals of DOE's Flue Gas Cleanup Program, namely the development of technologies to remove $S0_2$, NO_x, and particulates from coal-derived flue gas which are less expensive than the current technologies or more suitable for retrofit applications. The program will emphasize research on copper oxide and will also include research on titanium oxide and mixed copper/titanium oxide as well as on calcium oxide.

32760 (DOE/PC/89652–T10) **[Demonstration of selective catalytic reduction technology for the control NO_x emissions from high sulfur coal fired boilers]: Phase 3, Final report.** Southern Co. Services, Inc., Birmingham, AL (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-90PC89652. Order Number DE93017845. Source: OSTI; NTIS; GPO Dep.

Utilizing the detailed test plans developed in Task 1.2.4, the performance of the prototype SCR facility will be documented during this task. This task will include detailed parametric testing of both large and small SCR reactor/catalyst combinations as well as long-term catalyst performance. The process evaluation task will be under the primary responsibility of the Site Process Engineer in close coordination with the Site Operations Manager. Data collection support will be provided by contract chemistry support personnel and instrumentation technicians. The Site Process Engineer will be responsible to assure that the data are of good quality and adequately represent the testing called for in the Test Plan. The Site Process Engineer will also provide for the first level of data reductions prior to transmittal to the SCS Process Engineering staff in Birmingham. SCS R&EA process engineers will provide final data reduction and reporting to DOE and EPRI. Gulf Power will participate in project review meetings during this phase of the project. Gulf will review and comment on process data and recommend changes to operations and/or testing as appropriate.

32761 (DOE/PC/89778–T9) **Molten iron oxysulfide as a superior sulfur sorbent: First and second quarters progress report, September 1, 1989–March 1, 1990.** Hepworth, M.T. Minnesota Univ., Minneapolis, MN (United States). Mineral Resources Research Center. 6 Mar 1990. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-89PC89778. Order Number DE93019452. Source: OSTI; NTIS; GPO Dep.

Slagging combustors with injected lime or limestone are being considered as replacements for conventional coal burners. They have advantages in that they can be staged to reduce NO_x and SO_X emissions. Iron oxide, as an alternative to lime or limestone may be effective not only as a desulfurizing agent, but, under the right conditions of oxygen potential, it can act as a flux to produce a glassy slag. This glassy slag should be dense and environmentally inert. In this reporting period, the thermodynamic conditions for the operation of the first stage of a combustor operating on a Illinois No. 2 Coal have been examined with respect to the formation of the four phase equilibrium: FeO(wustite)/Fe/liquid/gas over the temperature 950° to 1300°C. The minimum dosages of iron oxide which are required at equilibrium and the calculated maximum percent sulfur removal are reported. Also given are the expected pounds of So, per million Btu of heat evolution calculated for complete combustion. These preliminary results indicate that higher temperatures, in the range studied, give better results approaching 96 percent sulfur removal from a coal containing (on a dry basis) 3.29% by weight sulfur. A comparison is made between iron oxide and lime as a desulfurizing agent.

32762 (DOE/PC/90309–11) **Anion-exchange resin-based desulfurization process: Quarterly technical progress report, April 1, 1993–June 30, 1993.** Sheth, A.C.; Dharmapurikar, R. Tennessee Univ., Tullahoma, TN (United States). Space Inst. [1993]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-90PC90309. Order Number DE93040618. Source: OSTI; NTIS; GPO Dep.

Under the current grant (No. DE-FG22-90PC90309), the University of Tennessee Space Institute (UTSI) will perform the bench scale evaluation and further development of the anion-exchange resin-based desulfurization concept to desulfurize alkali metal sulfates. The developmental program proposed under this DOE grant includes screening of commercially available resins to select three candidate resins for further study. These three resins will undergo a series of experiments designed to test the resins' performance under different process conditions (including the use of spent MHD seed material). The best of these resins will be used in optimizing the regeneration step and in testing the effects of performance enhancers. During this reporting period, April 1, 1993 to June 30, 1993, the procedure to evaluate the cycle efficiency of candidate resins in the fixed-bed mode was slightly modified to ensure complete regeneration of the exhausted resin. Using this revised procedure, ten consecutive cycles for all the three resins have been completed and the results are being analyzed.

32763 (DOE/PC/90546–T8) **Confined zone dispersion flue gas desulfurization demonstration: Quarterly report No. 7, May 1, 1992–August 16, 1992.** Bechtel Corp., San Francisco, CA (United States). 1 Feb 1993. 162p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-91PC90546. Order Number DE93040522. Source: OSTI; NTIS; GPO Dep.

The CZD process involves injecting a finely atomized slurry of reactive lime into the flue gas duct work of a coal-fired utility boiler. The principle of the confined zone is to form a wet zone of slurry droplets in the middle of the duct confined in an envelope of hot gas between the wet zone and the duct walls. The lime slurry reacts with part of the SO_2 in the gas, and the reaction products dry to form solid particles. A solids collector, typically an electrostatic precipitator (ESP) downstream from the point of injection, captures the reaction products along with the fly ash entrained in the flue gas. The features that distinguish the CZD process from other similar injection processes are: (1) Injection of an alkaline slurry directly into the duct, instead of injection of dry solids into the duct ahead of a fabric filter. (2) Use of an ultrafine calcium/magnesium

hydroxide, type S pressure-hydrated dolomitic lime. This commercial product is made from plentiful, naturally occurring dolomite. (3) Low residence time, made possible by the high effective surface area of the Type S lime. (4) Localized dispersion of the reagent. (5) Improved electrostatic precipitator performance via gas conditioning from the increased water vapor content, and lower temperatures. The waste product is composed of magnesium and calcium sulfite and sulfate, with some excess lime. This product mixed with fly ash is self-stabilizing because of the excess lime values, and thus tends to retain heavy metals in insoluble forms within the fly ash.

32764 (DOE/PC/90548–T9) **LIFAC Sorbent Injection Desulfurization Demonstration Project: Quarterly report No. 10, January–March 1993.** LIFAC North America, Inc., Oakland, CA (United States); ICF Kaiser Engineers, Inc., Pittsburgh, PA (United States); Tampella Power, Marietta, GA (United States). [1993]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-91PC90548. Order Number DE93040516. Source: OSTI; NTIS; GPO Dep.

Sorbent injection is a potentially important alternative to conventional wet lime and limestone scrubbing, and this project is another effort to test alternative sorbent injection approaches. in comparison to wet systems, LIFAC, with recirculation of the sorbent, removes less sulfur dioxide – 75–85% relative to 90% or greater for conventional scrubbers and requires more reagent material. However, if the demonstration is successful, LIFAC will offer these important advantages over wet scrubbing systems: Relatively easy to retrofit to an existing boiler and requires less area than conventional wet FGD systems; less expensive to install than conventional wet FGD processes; overall costs measured on a dollar-per-ton SO_2 removed basis are less; produces a dry, readily disposable waste by-product versus a wet product; and is relatively simple to operate. The site for the LIFAC demonstration is Richmond Power and Light's Whitewater Valley 2 pulverized coal-fired power station (60 MW), located in Richmond, Indiana.

32765 (DOE/PC/92521–T41) **Removal of CO_2 from flue gases by algae: [Quarterly] technical report, March 1, 1993–May 31, 1993.** Akin, C. (Inst. of Gas Technology, Chicago, IL (United States)); Pradhan, S. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019791. Source: OSTI; NTIS; GPO Dep.

A new set of simplified scaling laws has been proposed. When the gas to particle drag can be represented by the Ergun equation or similar expression, the new simplified scaling laws hold exactly in both the viscous dominated and gas inertial dominated limits. When the gas to particle drag is represented by drag on an isolated particle, the simplified scaling law also gives the correct limiting conditions for both the viscous and inertial limits. For intermediate conditions the gas to particle drag is also well approximated in models using the simplified scaling law. Tests of the newly developed simplified scaling laws and the viscous limit scaling laws proposed previously were conducted using several different beds and particle types running over particle Reynolds numbers between 2.5 and 50. Experimental results demonstrate that the solid to gas density must be closely matched for a scale model to properly simulate a combustor or chemical reactor outside the viscous limit. Within the viscous limit, the density ratio must also be matched to correctly model a circulating bed near the slugging limit. The simplified set of scaling parameters which includes U_0/U_{mf}, Froude number, solid-to-gas density ratio, sphericity, and particle size distribution should be valid for both small and large particle Reynolds numbers. The simplified set allowed the Studsvik 2.5 MW atmospheric combustor to be closely modeled by a cold bed with linear dimensions 1/16 that of the combustor. Larger scale factors may also be valid. The simplified scaling laws should also apply to pressurized fluidized beds. The simplified scaling laws were also used for an initial evaluation of convective heat transfer similarity. Experimental results show good agreement in Nusselt numbers between properly scaled beds.

32766 (DOE/PC/92521–T51) **Recovery and utilization of gypsum and limestone from scrubber sludge: [Quarterly] technical report, March 1, 1993–May 31, 1993.** Kawatra, S.K. (Michigan Technological Univ., Houghton, MI (United States). Dept. of Metallurgical and Materials Engineering); Eisele, T.C. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019801. Source: OSTI; NTIS; GPO Dep.

Wet flue-gas desulfurization units in coal-fired power plants produce a large amount of sludge which must be disposed of, and which is currently landfilled in most cases. Increasing landfill costs are gradually forcing utilities to find other alternatives. In principle, this sludge can be used to make gypsum ($CaSO_4$-$2H_2O$) for products such as plaster-of-Paris and wallboard, but only if impurities such as unreacted limestone and soluble salts are removed, and the calcium sulfite ($CaSO_3$) is oxidized to calcium sulfate ($CaSO_4$). This project is investigating methods for removing the impurities from the sludge so that high-quality, salable gypsum products can be made. Work done in the previous quarter concentrated on developing a low-cost froth flotation process that could remove limestone, unburned carbon, and related contaminants from the sludge while recovering the bulk of the calcium sulfite and gypsum. In the current quarter, experiments to remove impurities from the sludge using a water-only cyclone were conducted. The cyclone has been found to be effective for removing the coarser limestone impurities, as well as removing contaminants such as fine gravel and grinding-ball chips. These results show that the cyclone will be very complementary with froth flotation, which mainly removes the very fine impurities.

32767 (OCDO–93017598) **Ultrafine calcium aerosol: Generation and use as a sorbent for sulfur in coal combustion: Volume 1, Experimental work: Final report, August 1, 1988–October 31, 1991.** Alam, M.K. (Ohio Coal Research Center, Athens, OH (United States)); Nahar, N.U.; Stewart, G.D.; Prudich, M.E. (comps.). Ohio Coal Development Office, Columbus, OH (United States); Ohio Coal Research Center, Athens, OH (United States). Nov 1991. 96p. Sponsored by Ohio State Government, Columbus, OH (United States). Grant CDO/R-87-73. Source: OSTI; Ohio Coal Development Office, 77 S. High Street, P.O. Box 1001, Columbus, OH 43266-0001 (United States).

Studies conducted at Ohio University and elsewhere have demonstrated that ultrafine aerosols, which have the highest surface area per unit mass, have enhanced potential to efficiently remove sulfur dioxide form combustion gases. Therefore it is proposed to generate a very fine aerosol calcium-rich sorbent (or similar aerosols) for gas conditioning. The aerosol will be generated by vaporization of the sorbent compound and subsequent homogeneous nucleation. In experimental studies liquids as well as solids will be converted into ultrafine aerosols by using suitable aerosol generator. The aerosol generator could be a simple bubbler or a flame spray jet using powders of calcium "Compounds. Studies will then be carried out, to determine the dynamics of sulfur dioxide capture by the ultrafine aerosol. The primary objective of this research was to generate fine aerosols and to use them for coal combustion SO_2/NO_x gas removal purposes. From the background study on the dry scrubbing system, it can be concluded that the most important experimental parameters are addition ratio, reactor temperature, residence time, total inlet flow rate and inlet SO_2 concentration. Addition ratio is the inlet molar ratio of calcium to sulfur. Before any experimentation, it was necessary to decide and investigate the values of each of the parameters. Each of these parameters were investigated individually and the effects on SO_2 removal were determined.

32768 (OCDO–93017599) **Ultrafine calcium aerosol: Generation and use of a sorbent for sulfur in coal combustion: Volume 2, Economics: Final report, August 1, 1988–October 31, 1991.** Alam, M.K. (Ohio Coal Research Center, Athens, OH (United States)); Nahar, N.U.; Stewart, G.D.; Prudich, M.E. (comps.). Ohio Coal Development Office, Columbus, OH (United States); Ohio Coal Research Center, Athens, OH (United States). Nov 1991. 54p. Sponsored by Ohio State Government, Columbus, OH (United States). Grant CDO/R-87-73. Source: OSTI; Ohio Coal Development Office, 77 S. High Street, P.O. Box 1001, Columbus, OH 43266-0001 (United States).

The goal of this study is to determine the cost effectiveness of using calcium-hydroxide powder sorbent in a commercial power plant flue gas desulfurization (FGD) application. The cost analysis methodology found herein is a direct application of the one found in the January 1986 report, "Economic Evaluation of Dry-Injection Flue Gas Desulfurization Technology by the Electric Power Research Institute (EPRI). The EPRI study addresses the economic issue of installing a dry-injection FGD system on a 1000 MW (2-500 MW units) power plant using sodium-rich powder sorbents derived from nahcolite and trona ores. In this report's treatment, the calcium-based derivatives of hydrated limestone are compared directly to nahcolite and trona for both low and high sulfur coals. This type of evaluation is allowable due to the similar material handling properties of 1/4 inch hydrated limestone in comparison to those properties for nahcolite and trona. Thus, this report repeats the EPRI cost analysis for a slightly modified limestone-based FGD design. Note that the calculation methodology is not discussed, in this report as it has already been outlined in the EPRI study. Instead, Appendices A and B contain copies of the calculation spreadsheets based on the EPRI method for the hydrated limestone system.

32769 (UCRL-JC–111556) **Pulsed coronal discharge for combined removal of SO_2, NO_x and fly ash from flue gas.** Vogtlin, G.E. Lawrence Livermore National Lab., CA (United States). Sep 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920967–4: Advanced research workshop on non-thermal plasma techniques for pollution control, Cambridge (United Kingdom), 21-25 Sep 1992). Order Number DE93018094. Source: OSTI; NTIS; GPO Dep.

The processing chamber has been designed with an outer pipe of two inches in diameter. This tube can be used as an electrode, other geometries of smaller dimensions can be placed inside. A cross section is shown in Figure 1. The current reaction chamber is 15.24 cm in length, but can be increased as needed to match the impedance of the cable to that of the processor for maximum energy transfer. Configurations tested for NO removal are a 0.157 cm stainless wire in a 4.06 cm stainless tube, a 0.102 cm platinum wire in 2.54 cm tube lined with 0.0025 cm platinum foil, and a center conductor of 1.27 cm diameter thin brass discs spaced at 0.635 com in a 5.08 cm stainless tube. We have changed the charging circuit to allow high pulse rates. The present system performs well up to twenty pulses per second. Most of the data taken has been at a pulse rate of five pps. Part of the reason for this rate is that we want mixing to take place between pulses. The volume of the reaction chamber is approximately 0.3 lifers and the flow rate is from three to five liters/second. Once an optimum geometry is found we will determine the efficiency of single pass processing. This will include reducing the flow to be just in turbulent flow and then increasing the pulse rate. Since the system is eight liters and in turbulent flow then with a one liter/second flow we would pulse the system for eight seconds. This may cause a significant improvement at lower NO concentrations.

2005 Environmental Aspects

Refer also to citation(s) 33778, 33809

21 NUCLEAR POWER REACTORS AND ASSOCIATED PLANTS

32770 (DOE/OSTI–8200-R56) **Nuclear reactors built, being built, or planned 1992.** USDOE Office of Scientific and Technical Information, Oak Ridge, TN (United States). Jul 1993. 60p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93015065. Source: OSTI; NTIS; INIS; GPO Dep.

Nuclear Reactors Built, Being Built, or Planned contains unclassified information about facilities built, being built, or planned in the United States for domestic use or export as of December 31, 1992. The Office of Scientific and Technical Information, US Department of Energy, gathers this information annually from Washington headquarters and field offices of DOE from the US Nuclear Regulatory Commission (NRC); from the US reactor manufacturers who are the principal nuclear contractors for foreign reactor locations; from US and foreign embassies; and from foreign governmental nuclear departments. Information is presented on five parts: Civilian, Production, Military, Export and Critical Assembly.

2101 Power Reactors, Nonbreeding, Light-Water Moderated, Boiling Water Cooled

Refer also to citation(s) 32794, 32905, 32917, 32921, 32925, 32929, 32930

32771 (NUREG/GR–0005-Vol.2-Pt.1) **Risk-based inspection–Development of guidelines: Volume 2, part 1, light water reactor (LWR) nuclear power plant components.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Engineering; American Society of Mechanical Engineers, New York, NY (United States). Jul 1993. 157p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). (CRTD–Vol.20-2). Source: OSTI; NTIS; INIS; GPO.

Effective inservice inspection programs can play a significant role in minimizing equipment and structural failures. Most of the current inservice inspection programs for light water reactor (LWR) nuclear power plant components are based on experience and engineers' qualitative judgment. These programs include only an implicit consideration of risk, which combines the probability of failure of a component under its operation and loading conditions and the consequences of such failure, if it occurs. This document recommends appropriate methods for establishing a risk-based inspection program for LWR nuclear power plant components. The process has been built from a general methodology (Volume 1) and has been expanded to involve five major steps: defining the system; evaluating qualitative risk assessment results; using this and information from plant probabilistic risk assessments to perform a quantitative risk analysis; selecting target failure probabilities; and developing an inspection program for components using economic decision analysis and structural reliability assessment methods.

2102 Power Reactors, Nonbreeding, Light-Water Moderated, Nonboiling Water Cooled

Refer also to citation(s) 32588, 32771, 32794, 32796, 32817, 32905, 32907, 32909, 32911, 32919, 32921, 32922, 32925, 32928, 32929, 32935, 32936, 32937, 32938, 32939, 32940, 32945, 33146, 33153, 33208

32772 (INIS-mf–13548, pp. 19-26) **Investigation of the microstructure and mechanism of radiation embrittlement of materials for VVER-440 reactor vessels.** Gurovich, B.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (Russian Federation). Inst. Atomnoj Ehnergii); Lavrenchuk, O.V.; Novikov, A.V.; Kryukov, A.M. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 9.* 225p. Order Number DE94600002. Source: OSTI; NTIS (US Sales Only); INIS.

The paper presents the results of investigation of the microstructure of materials for the VVER-440 reactor vessels, obtained using the transmission and scanning electron microscopy. The reactor vessel materials - the base metal (15Kh2MFA steel) and the metal of welds produced using the welding wire SV-10KhVFT - were investigated in their initial states, after irradiation to fluences of about $(1x10^{23}\text{-}5x10^{24})m^{-2}$ (E>0.5 MeV) as well as after annealings of various durations. The results obtained have shown that radiation embrittlement of the materials for the VVER-440 reactor vessels is due to formation of radiation defects, small intra-grain precipitates and, hence, to increase in the yield point rather than to arise of harmful impurity grain boundary segregations. 4 refs.; 3 figs. (author).

32773 (INIS-mf–13548, pp. 34-41) **The irradiation conditions influence on fission products migration in fuel composition.** Elmanova, N.Z. (Moskovskij Fiziko-Tekhnicheskij Inst., Moscow (Russian Federation)). AN Ukrainskoj SSR, Kharkov (Ukraine).

Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247--: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 9.* 225p. Order Number DE94600002. Source: OSTI; NTIS (US Sales Only); INIS.

Solution of dynamic equations system for fission products migration and their radioactive transmutations in nuclear fuel is proposed. It is established that neutron capture reactions affect migration and release of fission products during irradiation. The calculated integral releases of rare gases during loss-of-coolant accident test are in a good agreement with measured ones in temperature range of 1300-1600^{0}C. The prediction of fission products release from fuel during lost-of-coolant accident of VVER-1000 reactor is presented. 10 refs.; 4 figs. (author).

32774 (KFKI–1992-26/G) **Development of an X Window based operator's interface for a core monitoring system.** Vegh, J. (Hungarian Academy of Sciences, Budapest (Hungary). Central Research Inst. for Physics); Huszar, J.; Laz, J. Hungarian Academy of Sciences, Budapest (Hungary). Central Research Inst. for Physics. Sep 1992. 27p. Order Number DE94600262. Source: OSTI; NTIS (US Sales Only); INIS.

The components, functioning and programming concepts of the man-machine interface applied in an upgraded version of the core monitoring system and reactor information system VERONA for WWER-440 type nuclear power reactors, installed at the Paks Nuclear Power Plant, are described. The application of the X Window standard Graphical User Interface facilitated modular interface design and made program development easier and faster. (author) 3 refs.; 13 figs.

2103 Power Reactors, Nonbreeding, Graphite Moderated

32775 (DOE/FTR–93014871) **Travel to Austria for meetings on research in radionuclide migration in soil-aquatic systems: Foreign trip report, February 29–March 7, 1992.** Onishi, Yasuo. Pacific Northwest Lab., Richland, WA (United States). 17 Mar 1992. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93014871. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of the travel are twofold: The first is to attend the Fourth Meeting of the IAEA/CEC Coordinated Research Programme on Validation of Environmental Model Prediction (VAMP) held during March 2 through 6, 1992 in Vienna, Austria to develop aquatic model test cases centering with Chernobyl accident data collected by Ukrainians and Russians, and the second is to coordinate activities of Program 7.1.F (Modeling the Behavior of Radionuclides in a Soil-Aquatic System Including Rivers and Reservoirs) of the US/USSR Joint Coordinating Committee on the Civilian Nuclear Reactor Safety (JCCCNRS) with the Ukrainian and Russian scientists who attended the VAMP meeting.

32776 (INIS-GB–492) **Statement of nuclear incidents at nuclear installations: second quarter 1992.** Health and Safety Executive, London (United Kingdom). 30 Sep 1992. 3p. Order Number DE94600270. Source: OSTI; NTIS (US Sales Only); INIS.

Two incidents are reported, neither of which gave rise to release of radioactivity. A treated water plant at the Trawsfynydd sewage plant overflowed. The radioactivity of the effluent was negligible but the discharge route was not authorised one and has therefore reported to the Health and Safety Executive: Float switches in the level control system have been modified as a result of the incident. At Hunterston-B nuclear power plant a fire in one of the reactors occurred during routine maintenance. No nuclear material was involved and no one was injured. However the reactor will be checked before being allowed to return to power. (UK).

32777 (ORNL/FTR–4326) **Travel to Germany to review testing of high-temperature gas-cooled reactor fuels and attend Fuels, Fission Products and Graphite Program meeting: Foreign trip report, May 30–June 6, 1992.** Kania, M.J. Oak Ridge National Lab., TN (United States). 17 Jul 1992. 38p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93014308. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Travel to the Forschungszentrum-Juelich covered in this report was for the purpose of attending the US/German Fuels, Fission Products and Graphite (FFPG) Subprogram Management Meeting. Highlights of the subprogram for the period from June 1991 through May 1992 were reviewed and the subprogram plan updated. A draft of revision 17 to the plan was prepared and provided to the US and German subprogram managers for review and concurrence. No new project work statements (PWSs) were presented for consideration. For FY 1992, the program continues to be effective in strengthening the Modular High Temperature Gas-Cooled Reactor (MHTGR) development in both the United States and Germany. However, with the termination of the German national HTR (high-temperature reactor) Program in December 1992, future cooperation appears to be in question. Continuation of key components of the German program proof-test irradiation experiments, accident simulation testing, and Post Irradiation Examination (PIE) of US fuel will be continued under basic research programs of the KFA primarily in the Institute of Reactor Development. The continuation of the Graphite Development Program remains in question. The dismantling and removal of HTR fuel fabrication capabilities represents the final blow to HTR development in Germany.

32778 (ORNL/FTR–4607) **US participation at the Fourth Coordination Research Program (CRP) meeting on validation of safety related physics calculations for low-enriched gas-cooled reactors: Foreign trip report, April 23–29, 1993.** Worley, B.A. Oak Ridge National Lab., TN (United States). 13 May 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93014748. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The traveler participated in an IAEA-sponsored Coordination Research Program (CRP) Meeting to review the status of a series of low-enriched uranium (LEU), graphite moderated critical experiments to be carried out under guidance of the Program member countries: China, Germany, Japan, Russia, Switzerland, and the United States. The first set of critical experiments are being carried out at the PROTEUS facility of the Paul Scherrer Institute in Villigen, Switzerland. The PROTEUS experiments will measure the effect of water ingress upon flux distributions and reflector control rod worths in an LEU graphite system, supplying new experimental data for use in validation of computer code predictions of important safety parameters. The PROTEUS series of experiments began in July 1992 and will be carried out over a period of two to three years. A follow-on set of experiments at the ASTRA facilities in Moscow are proposed by Russia. The proposed experiments would measure the temperature coefficient of reactivity in an LEU graphite core for core temperatures up to 1000 C. France has joined the CRP, indicating their country's interest in following the development of advanced reactor concepts. The Netherlands has sent a representative to the last two meetings, with the intention of joining the CRP within the next year.

2104 Power Reactors, Nonbreeding, Otherwise Moderated Or Unmoderated

Refer also to citation(s) 32588

32779 (NUREG/CR–6065) **Systems analysis of the CANDU 3 Reactor.** Wolfgong, J.R. (Oak Ridge National Lab., TN (United States)); Linn, M.A.; Wright, A.L.; Olszewski, M.; Fontana, M.H. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Systems Research; Oak Ridge National Lab., TN (United States). Jul 1993. 314p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/TM–12396). Source: OSTI; NTIS; INIS; GPO.

This report presents the results of a systems failure analysis study of the CANDU 3 reactor design; the study was performed for the US Nuclear Regulatory Commission. As part of the study a review of the CANDU 3 design documentation was performed, a plant assessment methodology was developed, representative plant initiating events were identified for detailed analysis, and a

plant assessment was performed. The results of the plant assessment included classification of the CANDU 3 event sequences that were analyzed, determination of CANDU 3 systems that are "significant to safety," and identification of key operator actions for the analyzed events.

2105 Power Reactors, Breeding

Refer also to citation(s) 32358

32780 (ANL-IFR-202) **Integral Fast Reactor Program: Annual progress report, FY 1992.** Chang, Y.I.; Walters, L.C.; Laidler, J.J.; Pedersen, D.R.; Wade, D.C.; Lineberry, M.J. Argonne National Lab., IL (United States). Jun 1993. 161p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93019498. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes highlights of the technical progress made in the Integral Fast Reactor (IFR) Program in FY 1992. Technical accomplishments are presented in the following areas of the IFR technology development activities: (1) metal fuel performance, (2) pyroprocess development, (3) safety experiments and analyses, (4) core design development, (5) fuel cycle demonstration, and (6) LMR technology R&D.

32781 (LA-UR-93-2537) **Application of neural network and pattern recognition software to the automated analysis of continuous nuclear monitoring of on-load reactors.** Howell, J.A. (Los Alamos National Lab., NM (United States)); Eccleston, G.W.; Halbig, J.K.; Klosterbuer, S.F.; Larson, T.W. Los Alamos National Lab., NM (United States). 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930749-48: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93018371. Source: OSTI; NTIS; GPO Dep.

Automated analysis using pattern recognition and neural network software can help interpret data, call attention to potential anomalies, and improve safeguards effectiveness. Automated software analysis, based on pattern recognition and neural networks, was applied to data collected from a radiation core discharge monitor system located adjacent to an on-load reactor core. Unattended radiation sensors continuously collect data to monitor on-line refueling operations in the reactor. The huge volume of data collected from a number of radiation channels makes it difficult for a safeguards inspector to review it all, check for consistency among the measurement channels, and find anomalies. Pattern recognition and neural network software can analyze large volumes of data from continuous, unattended measurements, thereby improving and automating the detection of anomalies. The authors developed a prototype pattern recognition program that determines the reactor power level and identifies the times when fuel bundles are pushed through the core during on-line refueling. Neural network models were also developed to predict fuel bundle burnup to calculate the region on the on-load reactor face from which fuel bundles were discharged based on the radiation signals. In the preliminary data set, which was limited and consisted of four distinct burnup regions, the neural network model correctly predicted the burnup region with an accuracy of 92%.

32782 (ORNL/TM-12344) **ALMR deployment economic analysis.** Delene, J.G.; Fuller, L.C.; Hudson, C.R. Oak Ridge National Lab., TN (United States). Jun 1993. 89p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93017935. Source: OSTI; NTIS; INIS; GPO Dep.

This analysis seeks to model and evaluate the economics of the use of Advanced Liquid Metal Reactors (ALMR) as a component of this country's future electricity generation mix. The ALMR concept has the ability to utilize as fuel the fissile material contained in previously irradiated nuclear fuel (i.e., spent fuel). While not a requirement for the successful deployment of ALMR power plant technology, the reprocessing of spent fuel from light water reactors (LWR) is necessary for any rapid introduction of ALMR power plants. In addition, the reprocessing of LWR spent fuel may reduce the number of high level waste repositories needed in the future by burning the long-lived actinides produced in the fission process. With this study, the relative economics of a number of potential scenarios related to these issues are evaluated. While not encompassing the full range of all possibilities, the cases reported here provide an indication of the potential costs, timings, and relative economic attractiveness of ALMR deployment.

2106 Power Reactors, Mobile, Propulsion, Package, and Transportable

32783 (DOE/FTR-93012117) **[Travel to Russia and Kazakhstan to participate in a fact finding visit to space nuclear propulsion and power facilities in the Commonwealth of Independent States (CIS)]: Foreign trip report, September 19-28, 1992.** Harmon, C.D. Sandia National Labs., Albuquerque, NM (United States). 16 Nov 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93012117. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The group was one of two delegations identified to visit the Commonwealth of Independent States (CIS), formerly the Soviet Union (FSU), to implement one of several proposals developed by the International Space Technology Assessment Program which was established by the Department of Energy in January 1992. This particular delegation focused on the space nuclear power and propulsion facilities located at Semipalatinsk-21, Kazakhstan, and planned their visit to coincide with the Third Specialist Conference, "Nuclear Power Engineering in Space", "Nuclear Rocket Engines", which convened at Semipalatinsk during the period 22-25 September 1992. The delegation was allowed limited access during three short visits lasting approximately 3 hours each. Based upon these visits, utilization of Kazakhstan facilities is definitely NOT a turn key situation. These reactor facilities appear to be operated and maintained by very competent staff within the limitations imposed upon them by their regulatory authorities. They are technically capable of supporting fuel element development by providing in-core analytical tools in the near term; however, significant resources will be necessary to achieve operational readiness for these reactor facilities in our current environmentally conscience culture.

32784 (DOE/FTR-93012256) **[Travel to Russia in support of the two multi-agency visits to the Commonwealth of Independent States scheduled for September and October]: Foreign trip report, September 11, 1992-October 12, 1992.** Perper, M.; Becker, B.; Pellechi, M. USDOE Office of Science and Technology, Washington, DC (United States). Office of Space. [1992]. 91p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93012256. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Within the framework of interagency cooperation on space activities, the Department of Energy (DOE) is coordinating a series of fact- finding visits to Commonwealth of Independent States (CIS) space institutes and facilities. The fact-finding visits are in support of DOE's International Space Technology Assessment Program (ISTAP), and Space Nuclear Power and Propulsion (SNPP). To facilitate these fact- finding visits, DOE has sent an Advance Team to Russia prior to the first DOE-led multi-agency delegation visit. The primary objectives of the DOE Advance Team were to (1) finalize arrangements for two multi-agency teams to visit Russian space institutes in September and October (Newhouse-led delegation and Carey-led delegation), (2) establish the scope of U.S.-Russian discussions during the two visits, and (3) understand the Russian expectations from such visits.

32785 (DTH-AEF-NT-4) **Nuclear ship accidents: Description and analysis.** Oelgaard, P.L. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Afd. for Elektrofysik. May 1993. 31p. Order Number DE94600277. Source: OSTI; NTIS; INIS.

In this report available information on 28 nuclear ship accident and incidents is considered. Of these 5 deals with U.S. ships and 23 with USSR ships. The ships are in almost all cases nuclear submarines. Only events that involve the nuclear propulsion plants, radiation exposures, fires/explosions and sea water leaks into the submarines are considered. Comments are made on each of the events, and at the end of the report an attempt is made to point

out the weaknesses of the submarine designs which have resulted in the accidents. It is emphasized that much of the available information is of a rather dubious nature. consequently some of the assessments made may not be correct. (au).

32786 (LA-SUB–93-216) **Shrinkage void formation and its effect on freeze and thaw processes of lithium and lithium-fluoride for space applications: [Final report].** Yang, Jae Young (Univ. of New Mexico, Albuquerque, NM (US). Dept. of Chemical & Nuclear Engineering); El-Genk, M.S. Los Alamos National Lab., NM (United States); New Mexico Univ., Albuquerque, NM (United States). Dept. of Chemical and Nuclear Engineering. 10 Jul 1991. 6p. Sponsored by Department of Defense, Washington, DC (United States); National Aeronautics and Space Administration, Washington, DC (United States). DOE Contract W-7405-ENG-36. Grant NAG. 3-1045;Contract 9-X60-D1200-1. Order Number DE93019303. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The effects of shrinkage void forming during freezing of lithium and lithium-fluoride on subsequent thaw processes are investigated using a numerical scheme that is based on a single (solid/liquid) cell approach. Results show that a void forming at the wall appreciably reduces the solid-liquid interface velocity, during both freeze and thaw, and causes a substantial rise in the wall temperature during thaw. However, in the case of Li, the maximum wall temperature was much lower than the melting temperature of PWC-11, which is used as the structure material in the SP-100 system. Hence, it is concluded that a formation of hot spots is unlikely during the startup or restart of the SP-100 system.

32787 (SAND–93-0529) **Some parametric flow analyses of a particle bed fuel element.** Dobranich, D. Sandia National Labs., Albuquerque, NM (United States). May 1993. 126p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018440. Source: OSTI; NTIS; GPO Dep.

Parametric calculations are performed, using the SAFSIM computer program, to investigate the fluid mechanics and heat transfer performance of a particle bed fuel element. Both steady-state and transient calculations are included, addressing such issues as flow stability, reduced thrust operation, transpiration drag, coolant conductivity enhancement, flow maldistributions, decay heat removal, flow perturbations, and pulse cooling. The calculations demonstrate the dependence of the predicted results on the modeling assumptions and thus provide guidance as to where further experimental and computational investigations are needed. The calculations also demonstrate that both flow instability and flow maldistribution in the fuel element are important phenomena. Furthermore, results are encouraging that geometric design changes to the element can significantly reduce problems related to these phenomena, allowing improved performance over a wide range of element power densities and flow rates. Such design changes will help to maximize the operational efficiency of space propulsion reactors employing particle bed fuel element technology. Finally, the results demonstrate that SAFSIM is a valuable engineering tool for performing quick and inexpensive parametric simulations addressing complex flow problems.

32788 (SAND–93-1263C) **A simple description of flow instability with application to a packed bed.** Dobranich, D. Sandia National Labs., Albuquerque, NM (United States). [1993]. 8p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930103–43: 10. symposium on space nuclear power and propulsion, Albuquerque, NM (United States), 10-14 Jan 1993). Order Number DE93017492. Source: OSTI; NTIS; GPO Dep.

A simplified explanation for gas flow instability in parallel heated channels is presented with specific applications to channels containing packed beds of power-producing particles. The explanation captures the basic governing physics of the viscosity-driven instability and hopefully removes some of the misconceptions surrounding this issue. Simple illustrative calculations, steady-state and transient, using the SAFSIM computer program are included in the explanation. The explanation points out that flow instability is common to any and all gas flow systems with parallel heated channels, that the addition of flow resistance to the entrance of a channel mitigates flow instability, and that instabilities do not occur instantaneously.

2107 Regulation and Licensing

Refer also to citation(s) 32811, 32845

32789 (NUREG–0540-Vol.15-No.5) **Title list of documents made publicly available, May 1–31, 1993: Volume 15, No. 5.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Freedom of Information and Publications Services. Jul 1993. 340p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

This document is a monthly publication containing descriptions of information received and generated by the US Nuclear Regulatory Commission (NRC). This information includes (1) docketed material associated with civilian nuclear power plants and other uses of radioactive material and (2) nondocketed material received and generated by NRC pertinent to its role as a regulatory agency. The following indexes are included: Personal Author, Corporate Source, Report Number, and Cross Reference of Enclosures to Principal Documents.

32790 (NUREG–0750-Vol.36-Index-2) **Indexes to Nuclear Regulatory Commission issuances, July–December 1992: Volume 36, Index 2.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Freedom of Information and Publications Services. Jun 1993. 68p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

Digests and indexes for issuances of the Commission (CLI), the Atomic Safety and Licensing Board Panel (LBP), the Administrative Law Judges (ALJ), the Directors' Decisions (DD), and the Denials of Petitions for Rulemaking (DPRM) are presented in this document. These digests and indexes are intended to serve as a guide to the issuances. These information elements are displayed in one or more of five separate formats arranged as follows: Case Name Index; Digests and Legal Citations Index, Subject Index, and Facility Index. Subject words and/or phrases arranged alphabetically, indicate the issues and subjects covered in the issuances. The subject headings are followed by phrases that give specific information about the subject, as discussed in the issuances being indexed. These phrases are followed by the issuance number and the full text reference.

32791 (NUREG–0750-Vol.37-Index-1) **Indexes to Nuclear Regulatory Commission issuances, January–March 1993: Volume 37, Index 1.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Freedom of Information and Publications Services. Jul 1993. 45p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

Digests and indexes for issuances of the Commission (CLI), the Atomic Safety and Licensing Board Panel (LBP), the Administrative Law Judges (ALJ), the Directors' Decisions (DD), and the Denials of Petitions for Rulemaking (DPRM) are presented in this document. These digests and indexes are intended to serve as a guide to the issuances. These information elements are displayed in one or more of five separate formats arranged as follows: Case name index; digests and headers; legal citations index; subject index; and facility index.

32792 (NUREG–0750-Vol.37-No.4) **Nuclear Regulatory Commission issuances, April 1993: Volume 37, No. 4.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Freedom of Information and Publications Services. Apr 1993. 108p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; INIS; GPO; NTIS.

This report includes the issuances received during the specified period from the commission (CLI), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judges (ALJ), the Directors' Decisions (DD), and the Denials of Petitions for Rulemaking (DPRM).

32793 (NUREG–0936-Vol.12-No.2) **NRC regulatory agenda: Quarterly report, April–June 1993: Volume 12, No. 2.** Nuclear

Regulatory Commission, Washington, DC (United States). Div. of Freedom of Information and Publications Services. Jul 1993. 121p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

The NRC Regulatory Agenda is a compilation of all rules on which the NRC has recently completed action, or has proposed action, or is considering action, and all petitions for rulemaking which have been received by the Commission and are pending disposition by the Commission. The Regulatory Agenda is updated and issued each quarter. The rules on which final action has been taken since March 31, 1993 are: Repeal of NRC standards of conduct; Fitness-for-duty requirements for licensees who possess, use, or transport Category I material; Training and qualification of nuclear power plant personnel; Monitoring the effectiveness of maintenance at nuclear power plants; Licensing requirements for land disposal of radioactive wastes; and Licensees' announcements of safeguards inspections.

32794 (NUREG–1461) **Regulatory analysis for the resolution of Generic Issue 153: Loss of essential service water in LWRs.** Su, T.M. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Safety Issue Resolution. Aug 1993. 23p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

In this report, the staff of the US Nuclear Regulatory Commission provides a regulatory analysis for the proposed resolution of Generic Issue 153 (GI-153), "Loss of Essential Service Water in LWRS." GI-153 deals with the concerns pertaining to the reliability of essential service water (ESW) system and related problems for all light water reactors except the seven multi-unit sites addressed by GI-130. "Essential Service Water Pump failures at Multi-Unit Sites." On the basis of the technical findings of a scoping study for GI-153, the staff recommends that the insights gained from the study serve as a complement to the on-going ESW performance inspection program. The staff also concludes that ESW system reliability is being addressed by various on-going regulatory programs. Therefore, the staff recommends that GI-153 should be considered "RESOLVED." The need for future action(s) on ESW reliability is expected to be determined from these on-going programs.

2108 Economics

Refer also to citation(s) 32782, 33018

32795 (ORNL/TM–10071/R3) **Cost estimate guidelines for advanced nuclear power technologies.** Delene, J.G.; Hudson, C.R. II. Oak Ridge National Lab., TN (United States). May 1993. 159p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93017937. Source: OSTI; NTIS; INIS; GPO Dep.

Several advanced power plant concepts are currently under development. These include the Modular High Temperature Gas Cooled Reactors, the Advanced Liquid Metal Reactor and the Advanced Light Water Reactors. One measure of the attractiveness of a new concept is its cost. Invariably, the cost of a new type of power plant will be compared with other alternative forms of electrical generation. This report provides a common starting point, whereby the cost estimates for the various power plants to be considered are developed with common assumptions and ground rules. Comparisons can then be made on a consistent basis. This is the second update of these cost estimate guidelines. Changes have been made to make the guidelines more current (January 1, 1992) and in response to suggestions made as a result of the use of the previous report. The principal changes are that the reference site has been changed from a generic Northeast (Middletown) site to a more central site (EPRI's East/West Central site) and that reference bulk commodity prices and labor productivity rates have been added. This report is designed to provide a framework for the preparation and reporting of costs. The cost estimates will consist of the overnight construction cost, the total plant capital cost, the operation and maintenance costs, the fuel costs, decommissioning costs and the power production or busbar generation cost.

22 NUCLEAR REACTOR TECHNOLOGY

32796 (DOE/FTR–93013013) **[Travel to attend the US electric power technologies conference held in Prague, Czechoslovakia]: Foreign trip report, July 7–9, 1992.** Rock, B.J. USDOE, Washington, DC (United States). 14 Aug 1992. 20p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93013013. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report covers the Nuclear Roundtable Discussions which were held on the first day and the subsequent Bilateral Meetings which followed on the second and third days.

32797 (WSRC-TR–93-100-3) **Savannah River Technology Center monthly report, March 1993.** Ferrell, J.M. Westinghouse Savannah River Co., Aiken, SC (United States). Mar 1993. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93018189. Source: OSTI; NTIS; GPO Dep.

This report outlines progress and accomplishments in the following categories: Reactor; Tritium; Separations; Environmental; Waste Management; and General. Reactor topics are a summary of the Applied Physics Group's work for the K-15.1 cycle; FLOWTRAN-TF code test certification, documentation, and reactor support; analysis of Mark 16B material from the L-Reactor Dissassembly Basin; the Reactor Tank inspection program T-Weld project; and Consistency Matrix support. Tritium topics are Leak Test Systems for the Container Management Facility; Replacement Tritium Facility technical issues tracking; transmission electron microscopy specimen preparation; the tritium aging effect on LaNi4.95A10.05 compressor material; and the life storage program. Separations topics are the F-Canyon Safety Analysis Report Addendum; an H-Canyon dissolver model; non-reactor assistance to the Nuclear Regulatory Commission; and onsite packaging criteria draft documentation. Environmental topics are Pond C studies with an underwater HPGe detector; the PREDICT run for the 1992 Annual Environmental Report; an integrated demonstration for cleanup of organic soils and groundwater at non-arid sites; and radio frequency soil heating – fiberoptic temperature measurement probes. Waste Management topics are adding sodium titanate to in-tank precipitation simulants; lab-scale stripper column defoaming tests; the development of an extended sludge processing batch one model; and a canister temperature study. General topics are video image capture system – drum inspection; old solvent tank characterization; plutonium storage containers; a glove box docking port; the development of SRS engineering and scientific software catalog; Nuclear Incident Monitor and criticality analysis for separations equipment development; and Nuclear Regulatory Commission assistance. Publications and other items of interest are cited at the end of this report.

2201 Theory and Calculation

Refer also to citation(s) 32778, 32812, 32834, 32899

32798 (DOE/ER/12931–2) **Systematic assembly homogenization and local flux reconstruction for nodal method calculations: Final report, January 1, 1990–September 30, 1992.** Dorning, J.J. Virginia Univ., Charlottesville, VA (United States). Dept. of Mechanical, Aerospace and Nuclear Engineering. May 1993. 64p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-90ER12931. (UVA–527406/MANE93/102). Order Number DE93017839. Source: OSTI; NTIS; GPO Dep.

The report is divided into three parts. The main mathematical development of the new systematic simultaneous lattice-cell and fuel-assembly homogenization theory derived from the transport equation is summarized in Part I. Also included in Part I is the validation of this systematic homogenization theory and the resulting calculational procedures for coarse-mesh nodal diffusion methods that follow from it, in the form of their application to a simple one-dimensional test problem. The results of the application of this transport-equation-based systematic homogenization theory are summarized in Part II in which its superior accuracy over traditional flux and volume weighted homogenization procedures and over generalized equivalence theory is demonstrated for small and large

practical two-dimensional PWR problems. The mathematical development of a second systematic homogenization theory – this one derived starting from the diffusion equation – is summarized in Part III where its application to a practical two-dimensional PWR model also is summarized and its superior accuracy over traditional homogenization methods and generalized equivalence theory is demonstrated for this problem.

2202 Components and Accessories

Refer also to citation(s) 32820, 32821, 32901, 32904, 32906, 32927, 32931, 32933, 32934, 32942, 32943, 32944, 33161, 33190, 33191, 33245, 34494

32799 (ANL/RE–93/2) **The exact solutions to the dynamic response of tanks containing two liquids.** Tang, Y.; Chang, Y.W. Argonne National Lab., IL (United States). Feb 1993. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93018048. Source: OSTI; NTIS; INIS; GPO Dep.

The exact solution to the dynamic response of circular cylindrical tanks containing two liquids, considering the gravitational (g) effect at the interface of the two liquids, is presented. Only rigid tanks were studied. The solution is expressed as the superposition of the so-called impulsive and convective solutions. The results are compared with those obtained by neglecting the gravitational effect at the interface to elucidate the g effect and with those of the tanks containing only one liquid to elucidate the effect of the interaction between two liquids. The response functions examined include the hydrodynamic pressure, base shear, base moments, sloshing motions at surface and at the interface of two liquids and the associated sloshing frequencies. It is found that there are two natural frequencies associated with each sloshing mode in contrast to only one frequency associated with each sloshing mode if the g effect at the interface is neglected; also, the convective pressure has a jump at the interface of two liquids, whereas the impulsive pressure is continuous at the interface. Further, it is shown that in a tank containing two liquids the maximum sloshing wave height may increase significantly, and the fundamental frequency of the sloshing motion is lower than that of an identical tank filled with only one liquid. Additionally, the well-known mechanical model for tanks containing one liquid is generalized for tanks containing two liquids.

32800 (DOE/FTR–93013397) **Travel to Japan to assess PNC's remote systems and robotics technologies for possible application in the DOE Environmental Restoration and Waste Management programs and to evaluate the potential for future exchange interactions: Foreign trip report, July 20–24, 1992.** Bennett, D.W. Pacific Northwest Lab., Richland, WA (United States). 28 Aug 1992. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93013397. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of this trip was to participate in a DOE delegation visiting Japan Power Reactor and Nuclear Fuels Development Corporation sites and facilities. The principle objective of the delegation was to evaluate the potential for future exchange interactions in the broad areas of robotics and remote technology associated with environmental restoration and waste management.

32801 (DOE/LLW–161) **Characterization of decommissioned reactor internals: Direct-assay method assessment.** Cline, J.E. EG and G Idaho, Inc., Idaho Falls, ID (United States); Cline (J.E.) and Associates, Inc., Rockville, MD (United States). Mar 1993. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93013739. Source: OSTI; NTIS; INIS; GPO Dep.

This study describes the direct-assay technique for measuring activation levels of irradiated reactor component hardware. It also compares the direct-assay technique with calculational analysis methods that predict activation levels. Direct assay is performed in four steps: (a) planning and component selection, (b) onsite measurements, (c) radiochemical analysis, and (d) data analysis and classification. Uncertainties are estimated for each step of this process, and an overall uncertainty in the classification accuracy is calculated as about ±35%. Numerous research ideas are identified to help reduce the uncertainty level; many of these ideas would improve activation determinations performed by either direct assay or by calculational analysis methods.

32802 (ETDE-IT–93-202) **Experimental researches on power plant condensers performed at ENEA laboratories.** Fabrizi, F. (ENEA, Casaccia (Italy). Area Energetica); Girardi, G.; Palazzi, G. 1993. 12p. (CONF-9303216–1: Condensation and condenser design, St Augustine, FL (United States), 8-12 Mar 1993). Order Number DE93522952. Source: OSTI; NTIS (US Sales Only).

Improvement of Italian industrial design capability is the principal aim of the ENEA (Italian Agency for Energy, New Technologies and the Environment) R&D program which is studying the thermo-hydraulic aspects of shell-and-tube condensers. The principal experimental apparatus of this project allows researchers to perform tests for investigating in detail feed-water heater (FWH) thermo-hydraulic performance. A scaled-down test section was used in significant size to reproduce condensing, de-superheating and drain cooling zones. To approach condensation phenomena occurring in the FWH, a visualization test section was also built. A new model for condensation flow, perpendicular to the tubes, was developed using the films shot through the visualization test section. All the experimental data carried out in the program were used to assess an original code, named COND. Concerning the tube-side condenser design, an analysis of the velocity field in the front end head was performed to minimize erosion phenomena.

32803 (INIS-mf–13548) **Radiation materials science. V. 9.** Zelenskij, V.F. (ed.). AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. 225p. (In Russian, English). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). Order Number DE94600002. Source: OSTI; NTIS (US Sales Only); INIS.

This volume includes the papers of the international conference on radiation materials in Alushta, Ukraine in May 1990. The main topics are: basic research in radiation damage physics, a study of the structural materials for reactor cores; irradiation effect on reactor vessel, fuel, super- and semiconductor materials; investigation damage research methods.

32804 (INIS-mf–13549) **Radiation materials science. V. 10.** Zelenskij, V.F. (ed.). AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. 214p. (In Russian, English). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). Order Number DE94600067. Source: OSTI; NTIS (US Sales Only); INIS.

This volume includes the papers of the international conference on radiation materials in Alushta, Ukraine in May 1990. The main topics are: basic research in radiation damage physics, a study of the structural materials for reactor cores; irradiation effect on reactor vessel, fuel, super- and semiconductor materials; investigation damage research methods.

32805 (INIS-mf–13549, pp. 98-104) **Information retrieval system on reactor test methods and role of methodic information in planning of research in reactor material science field.** Tsykanov, V.A. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (Russian Federation)); Ivanov, V.B.; Lebedeva, E.E.; Markina, N.V. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 10.* 214p. Order Number DE94600067. Source: OSTI; NTIS (US Sales Only); INIS.

The results of processing of methodic information which is systematized in form of an information retrieval system adapted for needs of researchers in material science field are represented. It permits to optimize planning of development and perfectioning the experimental base for reactor material science. (J.P.).

32806 (KFKI–1992-27/G) **Code for calculation of spreading of radioactivity in reactor containment systems: TIBSO code.** Vertes, P. Hungarian Academy of Sciences, Budapest (Hungary). Central Research Inst. for Physics. Sep 1992. 44p. Order Number DE94600250. Source: OSTI; NTIS (US Sales Only); INIS.

A detailed description of the new version of TIBSO code is given, with applications for accident analysis in a reactor containment system. The TIBSO code can follow the nuclear transition and the spatial migration of radioactive materials. The modelling of such processes is established in a very flexible way enabling the user to investigate a wide range of problems. The TIBSO code system is described in detail, taking into account the new developments since 1983. Most changes improve the capabilities of the code. The new version of TIBSO system is written in FORTRAN-77 and can be operated both under VAX VMS and PC DOS. (author) 5 refs.; 3 figs.; 21 tabs.

32807 (NUREG/CR–4744-Vol.7-No.2) **Long-term embrittlement of cast duplex stainless steels in LWR systems: Semiannual report, April–September 1992: Volume 7, No. 2.** Chopra, O.K. (Argonne National Lab., IL (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Div. of Engineering; Argonne National Lab., IL (United States). Jul 1993. 51p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract W-31109-ENG-38. (ANL–93/11). Source: OSTI; NTIS; INIS; GPO.

This progress report summarizes work performed by Argonne National Laboratory on longterm thermal embrittlement of cast duplex stainless steels in LWR systems during the six months from April–September 1992. A procedure and correlations are presented for predicting Charpy-impact energy, tensile flow stress, fracture toughness J-R curve, tearing modulus, and J_{IC} of aged cast stainless steels from known material information. The "saturation" impact strength and fracture toughness of a specific cast stainless steel, i.e., the minimum value that would be achieved for the material after long-term service, is estimated from the chemical composition of the steel. Mechanical properties as a function of time and temperature of reactor service are estimated from impact energy and flow stress of the unaged material and the kinetics of embrittlement, which are also determined from chemical composition. The J_{IC} values are determined from the estimated J-R curve and flow stress. Examples of estimating mechanical properties of cast stainless steel components during reactor service are presented. A common "lower-bound" J-R curve for cast stainless steels of unknown chemical composition is also defined for a given grade of steel, ferrite content, and temperature.

32808 (NUREG/CR–5404-Vol.2) **Auxiliary feedwater system aging study: Volume 2, Phase 1: Follow-on study.** Kueck, J.D. (Oak Ridge National Lab., TN (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Div. of Engineering; Oak Ridge National Lab., TN (United States). Jul 1993. 28p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL–6566/V1). Source: OSTI; NTIS; INIS; GPO.

This report documents the results of a Phase I follow-on study of the Auxiliary Feedwater (AFW) System that has been conducted for the US Regulatory Commission's Nuclear Plant Aging research Program. The Phase I study found a number of significant AFW System functions that are not being adequately tested by conventional test methods and some that are actually being degraded by conventional testing. Thus, it was decided that this follow-on study would focus on these testing omissions nd equipment degradation. The deficiencies in current monitoring and operating practice are categorized and evaluated. Areas of component degradation caused by current practice are discussed. Recommendations are made for improved diagnostic methods and test procedures.

32809 (NUREG/CR–6029-Vol.1) **Aging assessment of nuclear air-treatment system HEPA filters and adsorbers: Volume 1, Phase 1.** Winegardner, W.K. (Pacific Northwest Lab., Richland, WA (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Div. of Engineering; Pacific Northwest Lab., Richland, WA (United States). Aug 1993. 36p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC06-76RL01830. (PNL–8594-Vol.1). Source: OSTI; NTIS; INIS; GPO.

A Phase I aging assessment of high-efficiency particulate air (HEPA) filters and activated carbon gas adsorption units (adsorbers) was performed by the Pacific Northwest Laboratory (PNL) as part of the US Nuclear Regulatory Commission's (NRC) Nuclear Plant Aging Research (NPAR) Program. Information concerning design features; failure experience; aging mechanisms, effects, and stressors; and surveillance and monitoring methods for these key air-treatment system components was compiled. Over 1100 failures, or 12 percent of the filter installations, were reported as part of a Department of Energy (DOE) survey. Investigators from other national laboratories have suggested that aging effects could have contributed to over 80 percent of these failures. Tensile strength tests on aged filter media specimens indicated a decrease in strength. Filter aging mechanisms range from those associated with particle loading to reactions that alter properties of sealants and gaskets. Low radioiodine decontamination factors associated with the Three Mile Island (TMI) accident were attributed to the premature aging of the carbon in the adsorbers. Mechanisms that can lead to impaired adsorber performance include oxidation as well as the loss of potentially available active sites as a result of the adsorption of pollutants. Stressors include heat, moisture, radiation, and airborne particles and contaminants.

32810 (NUREG/CR–6060) **Hydrogen Mixing Studies (HMS) assessment manual.** Lam, K.L. (Los Alamos National Lab., NM (United States)); Wilson, T.L.; Travis, J.R. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Systems Research; Los Alamos National Lab., NM (United States). Jun 1993. 82p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract W-7405-ENG-36. (LA–12593-M). Source: OSTI; NTIS; INIS; GPO.

This report documents some calculations performed to assess the Hydrogen Mixing Studies (HMS) code. Results are presented first for some analytical test problems, including laminar flow and mass diffusion. The von Karman vortex street problem and the Sandia FLAME Facility and Heiss Dampf Reaktor (HDR) containment facility test problems are then discussed. For the analytical problems, the code gave results that agree exceptionally well with the analytical solutions. Calculations for the von Karman vortex street problem were performed at selected Reynolds numbers for several obstacle types. The computed flow patterns agree well with experimental observations-specifically the occurrence of a vortex street (double row of vortices) above a critical Reynolds number. Calculations for the von Karman vortex street problem were performed at selected Reynolds numbers for several obstacle types. The computed flow patterns agree well with experimental observations-specifically the occurrence of a vortex street (double row of vortices) above a critical Reynolds number. The last assessment problem involves modeling the experiment T31.5. The experiment was carried out in the HDR containment building, which is a large, multi-compartment facility (11 300 m^3 free volume in 72 compartments). In the experiment, a steam-water mixture was first injected into the containment to simulate a large-break blowdown of a pressure vessel, and then superheated steam was injected that was followed by a release of helium-hydrogen light gas. The calculated results (pressure, temperature, and gas concentrations) agree reasonably well with the experimental data.

32811 (SAND–93-7027) **Aging Management Guideline for commercial nuclear power plants: Electrical switchgear: Final report.** Toman, G. (Ogden Environmental and Energy Services Co., Inc., Blue Bell, PA (United States)); Gazdzinski, R.; Schuler, K. Sandia National Labs., Albuquerque, NM (United States); Ogden Environmental and Energy Services Co., Inc., Blue Bell, PA (United States). Jul 1993. 183p. Sponsored by USDOE, Washington, DC (United States); Electric Power Research Inst., Palo Alto, CA (United States). DOE Contract AC04-76DP00789. Order Number DE93018695. Source: OSTI; NTIS; INIS; GPO Dep.

This Aging Management Guideline (AMG) provides recommended methods for effective detection and mitigation of age-related degradation mechanisms in BWR and PWR commercial nuclear power plant electrical switchgear important to license renewal. The latent of this AMG to assist plant maintenance and operations personnel in maximizing the safe, useful life of these components. It also supports the documentation of effective aging management programs required under the License Renewal Rule 10 CFR Part 54. This AMG is presented in a manner which allows personnel responsible for performance analysis and maintenance,

to compare their plant-specific aging mechanisms (expected or already experienced) and aging management program activities to the more generic results and recommendations presented herein.

32812 (WHC-SA–1815) **Reactor vessel shielding with radioactive waste materials as burnable poisons.** Finfrock, S.H. Westinghouse Hanford Co., Richland, WA (United States). Jun 1993. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930913–23: Global '93: future nuclear systems - emerging fuel cycles and waste disposal options, Seattle, WA (United States), 12-17 Sep 1993). Order Number DE93019131. Source: OSTI; NTIS; INIS; GPO Dep.

An increasing concern in the nuclear industry is damage to reactor pressure vessels as a result of neutron fluence. This phenomena can significantly shorten reactor lifetime and, in some situations, has the potential to become a serious safety concern. As a result, finding methods to alleviate this problem is important to both current and next generation reactors. One technique discussed in this report and is currently being explored is to replace some of the outermost fuel pins with absorber pins that serve as an expendable shield for the reactor vessel. However, this concept is not new. The early US Department of Energy (DOE) production reactors at the Hanford Site used materials such as thorium and lithium to protect structural components from excessive neutron flux. In addition this shielding was used to produce special nuclear materials. While the production of special nuclear materials may no longer be of interest there may still be ways to put neutron shielding materials to good use. One possibility would be to use long-lived waste isotopes, such as ^{99}Tc and ^{129}I, as target materials that would be transmuted into shorter-lived waste forms. This would have the benefit of shielding the reactor vessel and, at the same time, eliminating the need for long-term storage of these problematic isotopes.

2203 Fuel Elements

Refer also to citation(s) 32916

32813 (INIS-mf–13548, pp. 42-48) **Investigation of WWER fuel elements in the changing loading regimes.** Andreev, V.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (Russian Federation). Inst. Atomnoj Ehnergii); Dubrovin, K.P.; Ivanov, E.G.; Kolyadin, V.I.; Yakovlev, V.V. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 9.* 225p. Order Number DE94600002. Source: OSTI; NTIS (US Sales Only); INIS.

The results of WWER-1000 fuel element behaviour investigation in conditions of cyclic thermal loading changes are presented. It was shown that fuel elements can, in principle, function under such conditions up to the average fuel burning which exceeds the design value for 3 years reactor operation. 2 refs.; 5 figs.; 2 tabs. (author).

32814 (INIS-mf–13548, pp. 83-90) **Determination of the structural and thermophysical parameters of fuel composition.** Artyukhin, E.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (Russian Federation). Inst. Atomnoj Ehnergii); Nenarokomov, A.V.; Tryanin, A.P.; Utenkov, S.A.; Yakovlev, V.V. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 9.* 225p. Order Number DE94600002. Source: OSTI; NTIS (US Sales Only); INIS.

Use of the methods for identifications of systems with distributed parameters makes it possible to investigate evolution of the main structural and thermophysical parameters of fuel compositions directly in the process of irradiation. The results of the calculations and experiments on the contact thermal resistance (CTR) between the fuel and VVER-440 cladding depending on the linear heat generating rate in the process raise the reactor power in the initial increase the reactor power are presented as an example of practical application of method. The experimental data for the VVER-440 fuel elements are presented. The effect of cracking of the pellets of the fuel elements filled with helium on dependence of CTR on linear heat generating rate is analyzed. The fact of pellet jump in the fuel elements filled with helium at a linear heat generating rate of about 200 W/cm are discussed. 5 refs.; 4 figs. (author).

32815 (SKI-TR–93-17) **Consequences of reactor fuel damage: - Production of radioactive wastes. - Radioactivity in the reactor cooling system.** Pulkkinen, R. (Vattenfall Energisystem, Vaellingby (Sweden)). Swedish Nuclear Power Inspectorate, Stockholm (Sweden). Jan 1993. 145p. (In Swedish). Order Number DE94600255. Source: OSTI; NTIS; INIS.

The report describes the consequences of damage of reactor fuel cladding. The types of damage and the release of fission products into the reactor cooling system are described as well as detection methods. The report also gives suggestions to reduce the consequences of a damage. (62 figs., 13 tabs.).

2204 Control Systems

Refer also to citation(s) 32915, 32947

32816 (BNL-NUREG–48663) **Local control stations.** Brown, W.S. (Brookhaven National Lab., Upton, NY (United States)); Higgins, J.C.; Wachtel, J.A. Brookhaven National Lab., Upton, NY (United States). [1993]. 14p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-931079–1: 20. water reactor safety information meeting, Bethesda, MD (United States), 20-23 Oct 1993). Order Number DE93013170. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes research concerning the effects of human engineering design at local control stations (i.e., operator interfaces located outside the control room) on human performance and plant safety. The research considered both multifunction panels (e.g. remote shutdown panels) as well as single-function interfaces (e.g., valves, breakers, gauges, etc.). Changes in performance shaping factors associated with variations in human engineering at LCSs were estimated based on expert opinion. By means of a scaling procedure, these estimates were used to modify the human error probabilities in a PRA model, which was then employed to generate estimates of plant risk and scoping-level value/impact ratios for various human engineering upgrades. Recent documentation of human engineering deficiencies at single-function LCSs was also reviewed, and an assessment of the current status of LCSs with respect to human engineering was conducted.

32817 (DOE/ER/75781–1) **Development of advanced direct perception displays for nuclear power plants to enhance monitoring, control and fault management: Progress report.** Jones, B.; Shaheen, S.; Moray, N.; Sanderson, P.; Reising, D.V. Illinois Univ., Urbana, IL (United States). 21 May 1993. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-92ER75781. Order Number DE93017906. Source: OSTI; NTIS; INIS; GPO Dep.

With recent theoretical and empirical research in basic and applied psychology, human factors, and engineering, it is now sufficient to define an integrated approach to the deign of advanced displays for present and future nuclear power plants. Traditionally, the conventional displays have shown operators the individual variables on gauges, meters, strip charts, etc. This design approach requires the operators to mentally integrate the separately displayed variables and determine the implications for the plant state. This traditional approach has been known as the single-sensor-single-indicator display design and it places an intolerable amount of mental workload on operators during transients and abnormal conditions. This report discusses a new alternative approach which is the use of direct perception interfaces. Direct perception a interfaces display the underlying physical and system constraints of the situation in a directly perceptual way, such that the viewer need not reason about what is seen to identify system states, but can identify the state of the system perceptually. It is expected that displays which show the dynamics of fundamental physical laws should better support operator decisions and diagnoses of plant states. The purpose of this research project is to develop a suite of direct perception displays for PWR nuclear power plant operations.

2205 Environmental Aspects

Refer also to citation(s) 32912, 32923, 32924, 33954, 34494

32818 (CONF-930913–13) **The source term and waste optimization of molten salt reactors with processing.** Gat, U. (Oak Ridge National Lab., TN (United States)); Dodds, H.L. Oak Ridge National Lab., TN (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Global '93: future nuclear systems - emerging fuel cycles and waste disposal options; Seattle, WA (United States); 12-17 Sep 1993. Order Number DE93017761. Source: OSTI; NTIS; INIS; GPO Dep.

The source term of a molten salt reactor (MSR) with fuel processing is reduced by the ratio of processing time to refueling time as compared to solid fuel reactors. The reduction, which can be one to two orders of magnitude, is due to removal of the long-lived fission products. The waste from MSRs can be optimized with respect to its chemical composition, concentration, mixture, shape, and size. The actinides and long-lived isotopes can be separated out and returned to the reactor for transmutation. These features make MSRs more acceptable and simpler in operation and handling.

32819 (EGG-NPR–10689) **Geophysical investigation: New Production Reactor Complex, Idaho National Engineering Laboratory.** Filipkowski, F. (Weston Geophysical Corp., Westboro, MA (US)); Blackey, M.; Davies, D.; Levine, E.N.; Murphy, V. EG and G Idaho, Inc., Idaho Falls, ID (United States); Weston Geophysical Corp., Westboro, MA (United States). Dec 1991. 64p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93019034. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Seismic crosshole and downhole velocity measurements were performed for two borehole arrays approximately 300 feet deep in conjunction with verticality measurements and geophysical logging of borehole WO-2 (to a depth of 4,960 feet) at the NPR site of the INEL. Past studies show that the site area is covered by a thin layer of soil which overlies numerous basalt flows interrupted by sandy and clayey interbeds. Compressional and shear wave velocities computed for these arrays revealed low velocity zones at the following elevation ranges for crosshole array No. 1: 4,893 feet to 4,873 feet (basalt rubble zone) and 4,705 feet to 4,686 feet (sediment interbed). Corresponding elevation ranges for crosshole array No. 2 include: 4,830 feet to 4,815 feet (sediment interbed), 4,785 feet to 4,765 feet (highly vesicular and fractured basalt), 4,715 feet to 4,705 feet (basalt rubble zone), and 4,672 feet to 4,667 feet (sediment interbed). In general, crosshole velocity data correlated between arrays with velocity differences possibly explained by localized lithologic changes. Due to scatter in the downhole velocity data, only velocity averages were computed. However, these downhole velocities correlated to the approximate mean crosshole velocity values and therefore independent confirmed the crosshole data. Geophysical logging of well WO-2 included natural gamma, neutron, and compensated density logs to a depth of 4,960 feet at which a viscous borehole fluid inhibited further investigation. Second runs of small sections of these logs were repeated satisfactorily for confirmation of certain anomalous areas.

32820 (NUREG/CP–0130-Vol.1) **Proceedings of the 22nd DOE/NRC Nuclear Air Cleaning Conference, Sessions 1–8: Volume 1.** First, M.W. (ed.) (Harvard Univ., Boston, MA (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research; Harvard Univ., Boston, MA (United States). Harvard Air Cleaning Lab.; USDOE Assistant Secretary for Nuclear Energy, Washington, DC (United States). Office of Nuclear Safety; International Society of Nuclear Air Treatment Technologies, Inc., Columbus, OH (United States). Jul 1993. 483p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States); USDOE, Washington, DC (United States). (CONF-920823–Vol.1: 22. Department of Energy (DOE)/Nuclear Regulatory Commission (NRC) nuclear air cleaning and treatment conference, Denver, CO (United States), 24-27 Aug 1992). Source: OSTI; NTIS; INIS; GPO.

This document contains the papers and the associated discussions of the 22nd DOE/NRC Nuclear Air Cleaning Conference. Major topics are: Advanced reactors, reprocessing, filter testing, waste management, instruments and sampling, reactor accidents, filters and filter performance, adsorber testing and performance, carbon testing, and ventilation systems. This document, Volume 1, provides Sessions 1 through 8. Individual papers have been cataloged separately.

32821 (NUREG/CP–0130-Vol.2) **Proceedings of the 22nd DOE/NRC Nuclear Air Cleaning Conference, Sessions 9–16: Volume 2.** First, M.W. (ed.) (Harvard Univ., Boston, MA (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research; Harvard Univ., Boston, MA (United States). Harvard Air Cleaning Lab.; USDOE Assistant Secretary for Nuclear Energy, Washington, DC (United States). Office of Nuclear Safety; International Society of Nuclear Air Treatment Technologies, Inc., Columbus, OH (United States). Jul 1993. 527p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States); USDOE, Washington, DC (United States). (CONF-920823–Vol.2: 22. Department of Energy (DOE)/Nuclear Regulatory Commission (NRC) nuclear air cleaning and treatment conference, Denver, CO (United States), 24-27 Aug 1992). Source: OSTI; NTIS; INIS; GPO.

This document contains the papers and the associated discussions of the 22nd DOE/NRC Nuclear Air Cleaning Conference Major topics are: advanced reactors, reprocessing, filter testing, waste management, instruments and sampling, reactor accidents, filters and filter performance, adsorber testing and performance, carbon testing, and ventilation systems. This document, Volume 2, contains sessions 9 through 16. Individual papers have been cataloged separately.

32822 (NUREG/CR–6058) **Virginia Regional Seismic Network: Final report (1986–1992).** Bollinger, G.A. (Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (US). Seismological Observatory); Sibol, M.S.; Chapman, M.C.; Snoke, J.A. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Engineering; Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (United States). Seismological Observatory. Jul 1993. 104p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; GPO.

In 1986, the Virginia Regional Seismic Network was one of the few fully calibrated digital seismic networks in the United States. Continued operation has resulted in the archival of signals from 2,000+ local, regional and teleseismic sources. Seismotectonic studies of the central Virginia seismic zone showed the activity in the western part to be related to a large antiformal structure while seismicity in the eastern portion is associated spatially with dike swarms. The eastern Tennessee seismic zone extends over a 300x50 km area and is the result of a compressive stress field acting at the intersection between two large crustal blocks. Hydroseismicity, which proposes a significant role for meteoric water in intraplate seismogenesis, found support in the observation of common cyclicities between streamflow and earthquake strain data. Seismic hazard studies have provided the following results: (1) Damage areas in the eastern United States are three to five times larger than those observed in the west. (2) Judged solely on the basis of cataloged earthquake recurrence rates, the next major shock in the southeast region will probably occur outside the Charleston, South Carolina area. (3) Investigations yielded necessary hazard parameters (for example, maximum magnitudes) for several sites in the southeast. Basic to these investigations was the development and maintenance of several seismological data bases.

2206 Research, Test, Training, Production, Irradiation, Materials Testing Reactors

Refer also to citation(s) 32332, 32589, 32770, 32797, 32812, 32818, 32819, 32913, 32915, 32916, 32940, 32941, 32946, 32947, 32948, 32949, 32951, 32952, 32954, 32955, 33334, 33733, 33954

32823 (CONF-930601–27) **The Advanced Neutron Source (ANS) project: A world-class research reactor facility.** Thompson, P.B. (Martin Marietta Energy Systems, Inc., Oak Ridge, TN (US)); Meek, W.E. Oak Ridge National Lab., TN (United States). [1993]. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From American Nuclear

Society (ANS) annual meeting; San Diego, CA (United States); 20-24 Jun 1993. Order Number DE93017851. Source: OSTI; NTIS; INIS; GPO Dep.

This paper provides an overview of the Advanced Neutron Source (ANS), a new research facility being designed at Oak Ridge National Laboratory. The facility is based on a 330 MW, heavy-water cooled and reflected reactor as the neutron source, with a thermal neutron flux of about $7.5 \times 10^{19} m^{-2} \cdot sec^{-1}$. Within the reflector region will be one hot source which will serve 2 hot neutron beam tubes, two cryogenic cold sources serving fourteen cold neutron beam tubes, two very cold beam tubes, and seven thermal neutron beam tubes. In addition there will be ten positions for materials irradiation experiments, five of them instrumented. The paper touches on the project status, safety concerns, cost estimates and scheduling, a description of the site, the reactor, and the arrangements of the facilities.

32824 (CONF-930913–14) **Molten salt treatment to minimize and optimize waste.** Gat, U. (Oak Ridge National Lab., TN (United States)); Crosley, S.M.; Gay, R.L. Oak Ridge National Lab., TN (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Global '93: future nuclear systems - emerging fuel cycles and waste disposal options; Seattle, WA (United States); 12-17 Sep 1993. Order Number DE93017762. Source: OSTI; NTIS; INIS; GPO Dep.

A combination molten salt oxidizer (MSO) and molten salt reactor (MSR) is described for treatment of waste. The MSO is proposed for contained oxidization of organic hazardous waste, for reduction of mass and volume of dilute waste by evaporation of the water. The NTSO residue is to be treated to optimize the waste in terms of its composition, chemical form, mixture, concentration, encapsulation, shape, size, and configuration. Accumulations and storage are minimized, shipments are sized for low risk. Actinides, fissile material, and long-lived isotopes are separated and completely burned or transmuted in an MSR. The MSR requires no fuel element fabrication, accepts the materials as salts in arbitrarily small quantities enhancing safety, security, and overall acceptability.

32825 (DOE/ER/75748–1) **Reactor fuel conversion assistance request: Technical progress report, August 15, 1992–May 14, 1993.** Tripard, G.E. Washington State Univ., Pullman, WA (United States). 1993. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-92ER75748. Order Number DE93015783. Source: OSTI; NTIS; GPO Dep.

This report is a summary of the progress that has been made on the preparations required to convert the WSU TRIGA reactor from High Enriched Uranium (HEU) fuel to Low Enriched Uranium (LEU) fuel.

32826 (DOE/FTR–93014671) **Travel to France to attend conference on Irradiation Technology: Foreign trip report, May 20–22, 1992.** Conner, J.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). 19 Jun 1992. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93014671. Source: OSTI; NTIS (US Sales Only); GPO Dep.

During the week of May 20–22, 1992, I attended an International Conference on Irradiation Technology. The conference was held at Centre de Saclay, a nuclear research and testing center located just outside of Paris, France. The Commissariate a l'Energie Atomique de France, Commission of the European communities, and JRC Institute for Advanced Materials of The Netherlands were joint sponsors of the event. Over two hundred individuals, representing twenty one countries and six different continents participated in the proceedings (preregistration list attached). My primary objective in attending was to assess ATR's capabilities against internationally demonstrated needs. The conference confirmed ATR's market analysis: (1) the international market place is exceedingly competitive, (2) there is a large potential market for ATR capabilities in the Orient, and (3) there is little demonstrated need for ATR within the European Economic Community (EEC). One additional finding was interest expressed by the Canadians to conduct a loop test in the 1994 time frame to support life extension of Ontario-Hydro's CANDU reactors.

32827 (DPSP–53-1-9-Del.Ver.) **Savannah River Works Technical Department progress report, September 1953.** Overbeck, W.P. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Plant. 9 Oct 1953. 69p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. Order Number DE93015756. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the Savannah River Works Technical Department during the month of September 1953.

32828 (DPSP–53-1-Del.Ver.) **Works Technical Department monthly progress report, January 1953.** Overbeck, W.P. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Plant. 6 Feb 1953. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. Order Number DE93016080. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the Savannah River Works Technical Department during the month of January 1953.

32829 (DPSP–54-1-4-Del.Ver.) **[Works Technical Department progress report, April 1954].** Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Plant. 4 May 1954. 85p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. Order Number DE93016025. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the Savannah River Works Technical Department during the month of April 1954.

32830 (DPSP–57-1-8-Del.Ver.) **Works Technical Department monthly progress report, August 1957.** Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Plant. 19 Sep 1957. 289p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. Order Number DE93016010. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the Works Technical Department during the month of August 1957.

32831 (DPSP–59-1-1-Del.Ver.) **[Works Technical Department progress report, January 1959].** Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Plant. 19 Feb 1959. 233p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. Order Number DE93016008. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the Savannah River Works Technical Department during the month of January 1959.

32832 (DPSP–59-1-2-Del.Ver.) **[Works Technical Department progress report, February 1959].** Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Plant. 18 Mar 1959. 287p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. Order Number DE93016007. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the Savannah River Works Technical Department during the month of February 1959.

32833 (DPSP–88-Del.Ver.) **Works Technical Department monthly progress report, October 1952.** Overbeck, W.P. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Plant. 6 Nov 1952. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. Order Number DE93016078. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details the activities of the Works Technical Department at Savannah River during the month of October 1952.

32834 (ERA-NRE–93-034) **Measured thermal and fast neutron fluence rates ATR Cycle 100-A: Internal technical report, March 15, 1993–April 22, 1993.** Smith, L.D.; Murray, R.K.; Rogers, J.W. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jun 1993. 75p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93018946. Source: OSTI; NTIS; GPO Dep.

This report contains the thermal (2200 m/s) and fast (E>IMeV) neutron fluence rate data for ATR Cycle 100-A which were measured by the Radiation Measurements Laboratory (RML) as requested by the Power Reactor Programs (ATR Experiments) Radiation Measurements Work Order. This report contains fluence rate values corresponding to the particular elevations (relative to

the 80 ft. core elevation) where the measurements were taken. The data in this report consists of (1) a table of the ATR power history and distribution, (2) a hard copy listing of all thermal and fast neutron-fluence rates, (3) plots of both the thermal and fast neutron fluence rates, and (4) a magnetic record (3.5 inch diskette) containing a listing of only the fast neutron fluence rates, their assigned elevations and proper header identification of all monitor positions contained herein.

32835 (HAN–2142) **[Office of Hanford Directed Operations activities for week of 20 October, 1947].** Derry, J.A. USAEC Hanford Operations Office, Richland, WA (United States). 23 Oct 1947. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019676. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending October 20, 1947.

32836 (HAN–2289) **Office of Hanford Directed Operations activities for week of October 27, 1947.** Derry, J.A. USAEC Hanford Operations Office, Richland, WA (United States). 30 Oct 1947. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019677. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending October 27, 1947.

32837 (HAN–2297) **Office of New York Directed Operations activities for week ending October 31, 1947.** Derry, J.A. USAEC Hanford Operations Office, Richland, WA (United States). 31 Oct 1947. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019678. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Office of New York Directed Operations for the week ending October 31, 1947.

32838 (HAN–2678) **[Office of Hanford Directed Operations activities for week of November 19, 1947].** Derry, J.A. USAEC Hanford Operations Office, Richland, WA (United States). 14 Nov 1947. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019660. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending November 10, 1947.

32839 (HAN–2992) **[Office of Hanford Directed Operations important happenings week of November 24, 1947].** Shugg, C. USAEC Hanford Operations Office, Richland, WA (United States). 26 Nov 1947. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019661. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending November 24, 1947.

32840 (HAN–3099) **[Office of Hanford Directed Operations important happenings week of November 17, 1947].** Shugg, C. USAEC Hanford Operations Office, Richland, WA (United States). 20 Nov 1947. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019662. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending November 17, 1947.

32841 (HAN–3605) **[Office of Hanford Directed Operations important happenings week of December 1, 1947].** Shaw, D.F. USAEC Hanford Operations Office, Richland, WA (United States). 4 Dec 1947. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019663. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Short communication. HANFORD RESERVATION/operation; HANFORD RESERVATION/program management; OPERATION; HANFORD PRODUCTION REACTORS; SEPARATION EQUIPMENT; SEPARATION PROCESSES; FUEL ELEMENTS; FABRICATION; CONSTRUCTION; PERSONNEL; KAPL

32842 (HAN–3845) **[Office of Hanford Directed Operations important happenings week of December 8, 1947].** Shugg, C. USAEC Hanford Operations Office, Richland, WA (United States). 11 Dec 1947. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019664. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Short communication. HANFORD RESERVATION/operation; HANFORD RESERVATION/program management; OPERATION; HANFORD PRODUCTION REACTORS; SEPARATION EQUIPMENT; SEPARATION PROCESSES; KAPL; CONSTRUCTION; PERSONNEL

32843 (HAN–4134) **[Office of Hanford Directed Operations important happenings week of December 15, 1947].** Shugg, C. USAEC Hanford Operations Office, Richland, WA (United States). 18 Dec 1947. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019665. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Short communication. HANFORD RESERVATION/operation; HANFORD RESERVATION/program management; SEPARATION PROCESSES; SEPARATION EQUIPMENT; CONSTRUCTION; KAPL; OPERATION; FUEL RODS

32844 (HAN–4714) **[Office of Hanford Directed Operations significant events for week of December 30, 1947].** Shugg, C. USAEC Hanford Operations Office, Richland, WA (United States). 31 Dec 1947. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019666. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending December 30, 1947.

32845 (HAN–4804) **[Office of Hanford Directed Operations – draft of statement for House Appropriations Committee].** Shugg, C. USAEC Hanford Operations Office, Richland, WA (United States). 6 Jan 1948. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019667. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Short communication. HANFORD RESERVATION/government policies; NATIONAL GOVERNMENT; HEARINGS

32846 (HAN–4926) **[Office of Hanford Directed Operations outstanding events for week ending January 8, 1948].** USAEC Hanford Operations Office, Richland, WA (United States). 8 Jan 1948. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019669. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending January 8, 1948.

32847 (HAN–5158) **[Office of Hanford Directed Operations happenings in week ended January 14, 1948].** USAEC Hanford Operations Office, Richland, WA (United States). 15 Jan 1948. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019670. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending January 14, 1948.

32848 (HAN–5491) **[Office of Hanford Directed Operations important occurrences for the week ending January 20, 1948].** USAEC Hanford Operations Office, Richland, WA (United States). 23 Jan 1948. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019671. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week of January 21, 1948.

32849 (HAN–5738) **Report of Hanford Directed Operations weekly activity, [January 28, 1948].** USAEC Hanford Operations Office, Richland, WA (United States). 29 Jan 1948. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019672. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending January 28, 1948.

32850 (HAN–6013) **[Office of Hanford Directed Operations events of importance for week of February 4, 1948].** Shugg, C. USAEC Hanford Operations Office, Richland, WA (United States). 5 Feb 1948. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019668. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending February 4, 1948.

32851 (HAN–6252) **[Office of Hanford Directed Operations important happenings for week ending February 11, 1948].** USAEC Hanford Operations Office, Richland, WA (United States). 12 Feb 1948. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019673. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending February 11, 1948.

32852 (HAN–6748) **[Office of Hanford Directed Operations important events for week ending February 25, 1948].** USAEC Hanford Operations Office, Richland, WA (United States). 26 Feb 1948. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019674. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending February 25, 1948.

32853 (HAN–10012) **[Office of Hanford Directed Operations significant happenings for week ending May 19, 1948].** USAEC Hanford Operations Office, Richland, WA (United States). 21 May 1948. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019675. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Short communication. HANFORD RESERVATION/operation; HANFORD RESERVATION/program management; OPERATION; HANFORD PRODUCTION REACTORS; SEPARATION EQUIPMENT; SEPARATION PROCESSES; CONSTRUCTION; PERSONNEL; FUEL RODS; KAPL

32854 (HAN–11152) **[Office of Hanford Directed Operations significant events for week ending June 9, 1948].** USAEC Hanford Operations Office, Richland, WA (United States). 21 Jun 1948. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019644. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending June 9, 1948.

32855 (HAN–11206) **[Office of Hanford Directed Operations major events for week ending June 16, 1948].** USAEC Hanford Operations Office, Richland, WA (United States). 16 Jun 1948. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019645. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending June 16, 1948.

32856 (HAN–11465) **[Office of Hanford Directed Operations significant events for week ending June 23, 1948].** USAEC Hanford Operations Office, Richland, WA (United States). 25 Jun 1948. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019646. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending June 23, 1948.

32857 (HAN–12091) **[Office of Hanford Directed Operations events of major importance for week ending July 7, 1948].** USAEC Hanford Operations Office, Richland, WA (United States). 7 Jul 1948. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019647. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending July 7, 1948.

32858 (HAN–12164) **[Office of Hanford Directed Operations events of importance for week ending July 14, 1948].** USAEC Hanford Operations Office, Richland, WA (United States). 15 Jul 1948. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019648. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending July 14, 1948.

32859 (HAN–12573) **[Office of Hanford Directed Operations events of importance for week ending July 21, 1948].** USAEC Hanford Operations Office, Richland, WA (United States). 22 Jul 1948. 2p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93019649. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending July 21, 1993.

32860 (HAN–12747) **[Office of Hanford Directed Operations events of importance for week ending July 28, 1948].** USAEC Hanford Operations Office, Richland, WA (United States). 29 Jul 1948. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019650. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending July 28, 1948.

32861 (HAN–13304) **[Office of Hanford Directed Operations events of importance for week ending August 11, 1948].** Shugg, C. USAEC Hanford Operations Office, Richland, WA (United States). 12 Aug 1948. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019651. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending August 11, 1948.

32862 (HAN–13496) **[Office of Hanford Directed Operations events of importance for week ending August 18, 1948].** USAEC Hanford Operations Office, Richland, WA (United States). 19 Aug 1948. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019653. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending August 18, 1948.

32863 (HAN–13728) **[Office of Hanford Directed Operations events of importance for week ending August 25, 1948].** USAEC Hanford Operations Office, Richland, WA (United States). 26 Aug 1948. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019652. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending August 25, 1948.

32864 (HAN–14412) **[Office of Hanford Directed Operations events of importance for week ending September 8, 1948].** Shaw, D.F. USAEC Hanford Operations Office, Richland, WA (United States). 10 Sep 1948. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019654. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending September 8, 1948.

32865 (HAN–14572) **[Office of Hanford Directed Operations events of importance for week ending September 15, 1948].** USAEC Hanford Operations Office, Richland, WA (United States). 16 Sep 1948. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019655. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending September 15, 1948.

32866 (HAN–14720) **[Office of Hanford Directed Operations events of importance for week ending September 1, 1948].** USAEC Hanford Operations Office, Richland, WA (United States). 2 Sep 1948. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019656. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending September 1, 1948.

32867 (HAN–15068) **[Office of Hanford Directed Operations events of importance for week ending September 22, 1948].** USAEC Hanford Operations Office, Richland, WA (United States). 23 Sep 1948. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019657. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending September 22, 1948.

32868 (HAN–15218) **[Office of Hanford Directed Operations events of importance for week ending September 29, 1948].** Schlemmer, P.C. USAEC Hanford Operations Office, Richland, WA (United States). 30 Sep 1948. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019658. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending September 29, 1948.

32869 (HAN–15464) **[Office of Hanford Directed Operations events of importance for week ending October 6, 1948].** USAEC Hanford Operations Office, Richland, WA (United States). 7 Oct 1948. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019659. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending October 6, 1948.

32870 (HAN–15784) **[Office of Hanford Directed Operations events of importance for week ending October 13, 1948].** USAEC Hanford Operations Office, Richland, WA (United States). 13 Oct 1948. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019635. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending October 13, 1948.

32871 (HAN–15937) **[Office of Hanford Directed Operations events of importance for week ending October 20, 1948].** Shaw, D.F. USAEC Hanford Operations Office, Richland, WA (United States). 22 Oct 1948. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019636. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending October 20, 1948.

32872 (HAN–16217) **[Office of Hanford Directed Operations events of importance for week ending October 27, 1948].** Shaw, D.F. USAEC Hanford Operations Office, Richland, WA (United States). 29 Oct 1948. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019637. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending October 27, 1948.

32873 (HAN–16762) **[Office of Hanford Directed Operations events of importance for week ending November 10, 1948].** Schlemmer, F.C. USAEC Hanford Operations Office, Richland, WA (United States). 12 Nov 1948. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019639. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Short communication. HANFORD RESERVATION/program management; HANFORD RESERVATION/operation; OPERATION; SEPARATION EQUIPMENT; SEPARATION PROCESSES; HANFORD PRODUCTION REACTORS; CONSTRUCTION; PERSONNEL; KAPL; COMMUNITIES

32874 (HAN–17159) **[Office of Hanford Directed Operations events of importance for week ending November 17, 1948].** Shaw, D.F. USAEC Hanford Operations Office, Richland, WA (United States). 19 Nov 1948. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019640. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending November 17, 1948.

32875 (HAN–17375) **[Office of Hanford Directed Operations events of importance for week ending November 24, 1948].** Shaw, D.F. USAEC Hanford Operations Office, Richland, WA (United States). 26 Nov 1948. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019641. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending November 24, 1948.

32876 (HAN–17665) **[Office of Hanford Directed Operations events of importance for week ending December 1, 1948].** Shaw, D.F. USAEC Hanford Operations Office, Richland, WA (United States). 3 Dec 1948. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019642. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending December 1, 1948.

32877 (HAN–17938) **[Office of Hanford Directed Operations events of importance for week ending December 8, 1948].** Shaw, D.F. USAEC Hanford Operations Office, Richland, WA (United States). 9 Dec 1948. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019643. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Short communication. HANFORD RESERVATION/operation; HANFORD RESERVATION/program management; OPERATION; HANFORD PRODUCTION REACTORS; SEPARATION EQUIPMENT; SEPARATION PROCESSES; CONSTRUCTION; PERSONNEL; KAPL; FUEL RODS; COMMUNITIES

32878 (HAN–18849) **[Office of Hanford Directed Operations events of importance for week ending December 29, 1948].** Shaw, D.F. USAEC Hanford Operations Office, Richland, WA (United States). 31 Dec 1948. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019704. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending December 29, 1948.

32879 (HAN–19118) **[Office of Hanford Directed Operations events of importance for week ending January 5, 1949].** Schlemmer, F.C. USAEC Hanford Operations Office, Richland, WA (United States). 7 Jan 1949. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019705. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending January 5, 1949.

32880 (HAN–19394) **[Office of Hanford Directed Operations events of importance for week ending January 12, 1949].** Schlemmer, F.C. USAEC Hanford Operations Office, Richland, WA (United States). 14 Jan 1949. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019706. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending January 12, 1949.

32881 (HAN–20229) **[Office of Hanford Directed Operations events of importance for week ending February 2, 1949].** Schlemmer, F.C. USAEC Hanford Operations Office, Richland, WA (United States). 4 Feb 1949. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019708. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operation Office for the week ending February 2, 1949.

32882 (HAN–20497) **[Office of Hanford Directed Operations events of importance for week ending February 9, 1949].** Travis, J.E. USAEC Hanford Operations Office, Richland, WA (United States). 11 Feb 1949. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019709. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending February 9, 1949.

32883 (HAN–21448) **[Office of Hanford Directed Operations events of importance for week ending March 2, 1949].** Schlemmer, F.C. USAEC Hanford Operations Office, Richland, WA (United States). 4 Mar 1949. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019712. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending March 2, 1949.

32884 (HAN–23207) **[Office of Hanford Directed Operations events of importance for week ending April 6, 1949].** Schlemmer, F.C. USAEC Hanford Operations Office, Richland, WA (United States). 8 Apr 1949. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019717. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending April 6, 1949.

32885 (HAN–23426) **[Office of Hanford Directed Operations events of importance for week ending April 13, 1949].** Schlemmer, F.C. USAEC Hanford Operations Office, Richland, WA (United States). 15 Apr 1949. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019718. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending April 13, 1949.

32886 (HAN–23866) **[Office of Hanford Directed Operations events of importance for week ending April 20, 1949].** Schlemmer, F.C. USAEC Hanford Operations Office, Richland, WA (United States). 22 Apr 1949. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019719. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending April 20, 1949.

32887 (HAN–24137) **[Office of Hanford Directed Operations events of importance for week ending April 27, 1949].** Schlemmer, F.C. USAEC Hanford Operations Office, Richland, WA (United States). 27 Apr 1949. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019720. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending April 27, 1949.

32888 (HAN–24860) **[Office of Hanford Directed Operations events of importance for week ending May 11, 1949].** Schlemmer, F.C. USAEC Hanford Operations Office, Richland, WA (United States). 13 May 1949. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019722. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending May 11, 1949.

32889 (HAN–25585) **[Office of Hanford Directed Operations events of importance for week ending May 25, 1949].** Schlemmer, F.C. USAEC Hanford Operations Office, Richland, WA (United States). 27 May 1949. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019724. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending May 25, 1949.

32890 (HAN–25824) **[Office of Hanford Directed Operations events of importance for week ending June 1, 1949].** Schlemmer, F.C. USAEC Hanford Operations Office, Richland, WA (United States). 3 Jun 1949. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019725. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending June 1, 1949.

32891 (HAN–26190) **[Office of Hanford Directed Operations events of importance for week ending June 8, 1949].** Schlemmer, F.C. USAEC Hanford Operations Office, Richland, WA (United States). 10 Jun 1949. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019726. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details events of importance reported by the Hanford Operations Office for the week ending June 8, 1949.

32892 (HW–28308) **Periodic and series reports Hanford Atomic Products Operation, 1943–1953.** Linkous, I.G. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 5 Jun 1953. 79p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93017355. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This is a listing of the classified periodic and series reports originated at the Hanford Atomic Products Operation for the period 1943 to June, 1953, and of similar reports received from the Hanford Operations Office. This listing also traces the continuity of reports that have undergone title changes during this period. This has been done by cross referencing to titles previously or subsequently used. The primary grouping of these reports is according to the intervals at which they were issued, e.g., weekly, monthly, annually, etc. Within each group, the reports are arranged alphabetically by title; for each individual title a note at the right hand margin gives the inclusive dates for the period during which reports of that title were issued. Those not shown with closing date are being issued currently. Specific document numbers for each title are found in the catalogs of the 700 Area and 300 Area Classified Files. The list is intended primarily to assist Classified Files in locating periodic reports requested by Plant personnel. However, it is also hoped that it may emphasize to authors the need for retaining an established title for a periodic report. Unnecessary changes of title every few months for the same periodic report greatly complicate the problem of organizing the reports collection for reference use.

32893 (HW–34868-Ch.11) **Nuclear metallurgy lectures.** Last, G.A. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 25 May 1955. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019817. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Short communication HANFORD PRODUCTION REACTORS/ fuel elements; URANIUM/materials working; HAPO; URANIUM; ROLLING; CASTING; EXTRUSION; HEAT TREATMENTS; METALLURGY; PHYSICAL RADIATION EFFECTS; DIMENSIONS; DEFORMATION

32894 (HW–54972) **Chemical Processing requirements HAPO New Production Reactor.** MacCready, W.K. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 13 Feb 1958. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93041258. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Short communication. HANFORD PRODUCTION REACTORS; PLUTONIUM/production; PRODUCTION/capitalized cost; PRODUCTION/operating cost; HAPO; SEPARATION PROCESSES; SEPARATION EQUIPMENT; PLUTONIUM; PRODUCTION; PROCESSING

32895 (HW–75700-Del.) **[Hanford Atomic Products Operations: 1962 annual report].** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 15 Mar 1963. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93014281. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This annual report details activities of the Hanford Atomic Products Operation (HAPO) during 1962.

32896 (PNL-SA–21780) **United States experience in graphite moderated, channel reactor safety upgrades.**

Mikkelsen, K.R. Pacific Northwest Lab., Richland, WA (United States). Jun 1993. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9306189–4: NE '93: 4th annual scientific and technical conference of the Nuclear Society: nuclear energy and human safety, Nizhni Novgorod (Russian Federation), 28 Jun - 2 jul 1993). Order Number DE93018002. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides a discussion of the operating experience in graphite moderated channel reactor safety upgrades. A historical background of the Hanford production reactors is provided.

32897 (SAND–92-1094) **Evaluation of fiber optic performance in the ACRR.** Bodette, D.E.; Brannon, P.J. Sandia National Labs., Albuquerque, NM (United States). May 1993. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018515. Source: OSTI; NTIS; INIS; GPO Dep.

Four fluorosilica clad, all silica core fibers with polyamide buffers were examined for radiation-induced, transient absorption in the central cavity of the Annular Core Research Reactor. The reactor operated 24 times in the pulse mode, typically yielding gamma doses of 15 krad(Si) and neutron fluences of 1.4 $\times 10^{14}$ nts/cm^2 thermal and 1.0 $\times$ 10^{15} nts/cm^2 (fast). The two low-OH fibers absorbed 90% of the light in the 400 to 500 nm region and 30% in the 700 and 800 nm region. The high-OH fibers absorbed 20% in the 400 to 500 nm region and 50% in the 700 to 800 nm region. Saturation of the transient induced absorption was observed in all the fibers. No systematic measurements were taken of long term induced absorption. However, excessive absorption was not a problem in any fibers, even those that received total gamma doses of 5 Mrad(Si). Scintillation in the 680 to 820 mn band was observed. This report documents the data from these experiments.

32898 (SAND–92-2593) **Investigation of options for venting and filtering of nuclear reactor plants.** Ludwigsen, J.S. Sandia National Labs., Albuquerque, NM (United States). Jun 1993. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (NPRW-CON–91-3). Order Number DE93018688. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The Department of Energy is currently funding the design of a New Production Reactor-Heavy Water Reactor (NPR-HWR) to produce tritium. As part of the defense-in-depth philosophy toward safety, the possible use of a filtered vent system is being investigated for application to the containment system. Based on the ability of a filtered vent to reduce radionuclide releases from slow overpressurization accidents, several European commercial reactor containments have installed systems over the last decade. The design of these systems, their ability to reduce the risk of radionuclide releases and how a similar filtered vent system would apply to the NPR-HWR are investigated.

32899 (SAND–93-1481C) **Estimation of maximum temperatures in spallation targets.** Boyack, K.W.; Sherman, M.P.; Kelly, J.E. Sandia National Labs., Albuquerque, NM (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-931160–11: American Nuclear Society (ANS) winter meeting, San Francisco, CA (United States), 14-19 Nov 1993). Order Number DE93017493. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. TARGETS/radiation heating; SPALLATION; TARGETS; HEAT TRANSFER; LOSS OF COOLANT; FUEL RODS; WATER COOLED REACTORS; POWER DENSITY; TEMPERATURE DISTRIBUTION

32900 (WHC-SA–1816) **Hanford Site production reactor data pertinent to actinide burning.** Toffer, H.; Roblyer, S.P. Westinghouse Hanford Co., Richland, WA (United States). Jun 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930913–21: Global '93: future nuclear systems - emerging fuel cycles and waste disposal options, Seattle, WA (United States), 12-17 Sep 1993). Order Number DE93019129. Source: OSTI; NTIS; INIS; GPO Dep.

During the 44 years of operation, irradiation of special actinides occurred in the Hanford Site production reactors. The data derived from such irradiations could be of value to advanced actinide burners having a thermal neutron spectrum. Recently, such information has become unclassified and, therefore available for public release. This data is discussed in this report.

32901 (WSRC-MS–92-460) **Acceptance criteria for in-service inspection of heat exchanger head and shell components.** Lam, P.S.; Sindelar, R.L.; Awadalla, N.G. Westinghouse Savannah River Co., Aiken, SC (United States). [1992]. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-931121–8: Annual winter meeting of the American Society of Mechanical Engineers, New Orleans, LA (United States), 28 Nov - 3 dec 1993). Order Number DE93015830. Source: OSTI; NTIS; GPO Dep.

This report discusses several heat exchanger structural components of the Savannah River Site (SRS) production reactors, comprising the pressure boundary for the primary or secondary coolant systems, which are monitored through in-service inspection. An acceptance criteria methodology is provided to disposition flaws detected during examination of these components. The methodology ensures that the safety margins against failure through flaw instability are maintained throughout service. Acceptance criteria are established to define the acceptable flaw configurations. The acceptable flaw lengths are estimated based on the flaw stability solutions for throughwall cracks. To limit the flaw depths for leakage prevention, the acceptable depths are set to 75% of the plate thicknesses for flaws with lengths up to the acceptable flaw length. The stresses acting on the heat exchanger components were obtained by simple analytical and finite element solutions. The stability of postulated flaws were evaluated tic-plastic fracture mechanics and limit load analyses. Curvature correction with methods were employed to approximate solutions for flaws on curved shells.

32902 (WSRC-TR–91-395) **Re-evaluation of the 1962 Mark VI-B dynamic tests regarding reactivity coefficients.** Burnett, T. (ESC-NATD/NS (US)); Hightower, N.T. III. Westinghouse Savannah River Co., Aiken, SC (United States). Jun 1991. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93018195. Source: OSTI; NTIS; GPO Dep.

The 1962 Mark VI-B rod tests have been re-evaluated. A significantly lower (more negative) coolant coefficient is now ascribed to that test, −1 pcm/Deg-C vs the previously reported +2 pcm/Deg-C. The change from the previous value is because of revisions to delayed neutron constants and accounting for spatial effects. The new value is in reasonable agreement with the currently calculated value of −2 pcm/Deg-C, considering measurement and calculational uncertainties. Therefore, the authors conclude that the current analytic models for physics and transient analysis methodology (GLASS, GRIMHX & TRIMHX, AND MARY) are fully consistent with 1962 test observations, and that there is no basis for assigning a calculational bias or increasing uncertainty allowances.

32903 (WSRC-TR–91-646-Rev.1) **Update and extension of Mark 22 energy redistribution factors for HMTABLE: Revision 1.** Frost, R.L. Westinghouse Savannah River Co., Aiken, SC (United States). Nov 1992. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93018196. Source: OSTI; NTIS; INIS; GPO Dep.

This first revision was issued to correct errors in the notation used in the discussion of errors. The only changes are on pages 7 and 8 and in the headings of Tables 5 and 6. No changes or updates have been made to any of the data. The ability to predict decay heat resulting from radioactive decay of fission products and activated isotopes following assembly irradiation is necessary to determine the coolability of assemblies under various scenarios. These scenarios include assemblies in core, in transit from the core to the disassembly basin, and cask transit from the reactor buildings to the separations areas. At the Savannah River Site (SRS), decay heat calculations are based on the 1979 ANSI 5.1 standard, "Decay Heat Power in Light Water Reactors". Data from this standard is used in conjunction with an energy redistribution factor, G(t,T), which accounts for the redistribution of gamma energy in a heterogeneous SRS reactor core. This factor is calculated for SRS reactors under the desired conditions using the GLASS and SHIELD codes. The HMTABLE (Hydraulics Manual TABLE) code performs the necessary calculations using data from

these two sources. The use of this methodology for SRS reactors has been validated.

32904 (WSRC-TR–92-425) **Heat exchanger, head and shell acceptance criteria.** Lam, P.S.; Sindelar, R.L. Westinghouse Savannah River Co., Aiken, SC (United States). Sep 1992. 47p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93018262. Source: OSTI; NTIS; INIS; GPO Dep.

Instability of postulated flaws in the head component of the heat exchanger could not produce a large break, equivalent to a DEGB in the PWS piping, due to the configuration of the head and restraint provided by the staybolts. Rather, leakage from throughwall flaws in the head would increase with flaw length with finite leakage areas that are bounded by a post-instability flaw configuration. Postulated flaws at instability in the shell of the heat exchanger or in the cooling water nozzles could produce a large break in the Cooling Water System (CWS) pressure boundary. An initial analysis of flaw stability for postulated flaws in the heat exchanger head was performed in January 1992. This present report updates that analysis and, additionally, provides acceptable flaw configurations to maintain defined structural or safety margins against flaw instability of the external pressure boundary components of the heat exchanger, namely the head, shell, and cooling water nozzles. Structural and flaw stability analyses of the heat exchanger tubes, the internal pressure boundary of the heat exchangers or interface boundary between the PWS and CWS, were previously completed in February 1992 as part of the heat exchanger restart evaluation and are not covered in this report.

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Refer also to citation(s) 32540, 32563, 32589, 32777, 32778, 32779, 32780, 32794, 32808, 32809, 32811, 32816, 32820, 32821, 32898, 33915, 33950

32905 (ANL/RE/CP–78655) **Analyses of fluid-structure interaction and structural response of reactor vessels to a postulated accident.** Wang, C.Y. Argonne National Lab., IL (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930803–18: 12. biennial conference for the International Association for Structural Mechanics in Reactor Technology (SMIRT 12), Stuttgart (Germany), 16-26 Aug 1993). Order Number DE93018992. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes fluid-structure-interaction and structure response analyses of a reactor vessel subjected to loadings associated with postulated accidents, using the improved hybrid Lagrangian-Eulerian code ALICE-II. The objective of the present analyses is to study the cover response and potential for missile generation in response to a fuel-coolant interaction in the core region. Three calculations were performed using the cover weight as a parameter. To study the effect of the cavity water outside the reactor vessel, vessel response calculations for both wet- and dry-cavity designs are compared. Results indicate that for all cases studied and for the design parameters assumed, the calculated cover displacements are all smaller than the bolts' ultimate displacement and no missile generation of the closure head is predicted. Also, solutions reveal that the cavity water of the wet-cavity design plays an important role of restraining the downward displacement of the bottom head. Based on these studies, the analyses predict that the structure integrity is maintained throughout the postulated accident for the wet-cavity design.

32906 (ANL/RE/CP–78807) **Seismic response of a base-isolated building with high damping, low shear modulus elastomeric bearings.** Wang, C.Y. (Argonne National Lab., IL (United States)); Chang, Y.W.; Kulak, R.F.; Seidensticker, R.W.; Kuroda, T.; Kobatake, M. Argonne National Lab., IL (United States). [1993]. 7p. Sponsored by National Science Foundation, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930803–19: 12. biennial conference for the International Association for Structural Mechanics in Reactor Technology (SMIRT 12), Stuttgart (Germany), 16-26 Aug 1993). Order Number DE93019022. Source: OSTI; NTIS; INIS; GPO Dep.

This paper deals with an investigation of seismic responses of a base-isolated building subjected to actual earthquakes. The isolation system consists of six medium shape factor, high damping, low shear modulus bearings designed by ANL and manufactured in the United Kingdom. The objective is two-fold: (1) to study the effectiveness of the isolated bearings through responses of the test building under actual earthquakes, and (2) to validate the 3-D SISEC (Seismic Isolation System Evaluation Code) program. Results obtained from the earthquake observations indicate that the advantage of the base-isolation system in mitigating the acceleration of the superstructure is very pronounced. For earthquakes #42 and #44, the accelerations at the roof level of the isolated building are only 20% to 30% of the ordinary building accelerations. Also, for both ordinary and base-isolated buildings the computed accelerations agree reasonably well with those recorded.

32907 (ANL/RE/CP–80363) **Floor response spectra for seismic qualification of Kozloduy VVER 440-230 NPP.** Kostov, M.K. (Bulgarian Academy of Sciences, Sofia (BG). Central Lab. for Seismic Mechanics and Earthquake Engineering); Ma, D.C.; Prato, C.A.; Stevenson, J.D. Argonne National Lab., IL (United States). [1993]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9308139–1: SMIRT-12: Structural Mechanics in Reactor Technology conference on upgrading of existing 440 and 1000 MW VVER type pressurized water reactors for severe external loading conditions, Vienna (Austria), 23-25 Aug 1993). Order Number DE93018588. Source: OSTI; NTIS; INIS; GPO Dep.

In this paper the floor response spectra generation methodology for Kozloduy NPP, Unit 1-2 of VVER 440-230 is presented. The 2D coupled soil-structure interaction models are used combined with a simplified correction of the final results for accounting of torsional effects. Both time history and direct approach for in-structure spectra generation are used and discussion of results is made.

32908 (DOE/FTR–93011811) **[Travel to Moscow, Russia to discuss nuclear power plant aging and life extension]: Foreign trip report, October 12–20, 1992.** Harrison, D.L. USDOE, Washington, DC (United States). 27 Nov 1992. 27p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93011811. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The traveler participated in the third meeting of Working Group 12 of U.S.-R.F. JCCCNRS held in Moscow, Russia, during October 12–16, 1992. This document contains a compilation of brief summaries of the presentations made during the meeting. Also included is a memorandum of the meeting (MOM92-2), which provides a status of the Working Group tasks and includes attachments listing the R.F. Working Group participants and guests, the U.S. Working Group participants, the meeting program, and a workshop program.

32909 (DOE/FTR–93013015) **[Travel to Vienna, Austria and Brussels, Belgium to meet with IAEA persons involved in DOE/AID assistance program and to meet with G-24 to coordinate AID to CEEC and FSU]: Foreign trip report, July 13–17, 1992.** Horton, K.E. USDOE, Washington, DC (United States). 14 Aug 1992. 5p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93013015. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report presents a summary of all meetings attended by the traveler.

32910 (DOE/FTR–93013407) **[Travel to Vilnius, Lithuania, Vienna, Austria, Bratislava and Prague Czechoslovakia to assess nuclear related needs for Lithuania and to discuss future nuclear safety assistance efforts with all of the countries visited]: Foreign trip report, September 16–24, 1992.** Horton, K.E. USDOE, Washington, DC (United States). 5 Oct 1992. 31p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93013407. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of the travel reported in this report was to: Meet with Lithuanian Energy officials to discuss US nuclear safety assistance under the AID Regional Energy Efficiency Program; meet with IAEA program managers to discuss status of US funded TC programs for nuclear assistance to Eastern Europe; meet with Slovak Republic utility and energy officials to assess impacts of

country split on nuclear regulation and safety programs, and to assess changes in the US program of assistance to accommodate the country split; and meet with officials of the Czechoslovak Atomic Energy Commission to discuss current and future nuclear safety assistance programs.

32911 (DOE/FTR–93014205) **Travel to Korea to discuss the RELAP5/MOD3 code at the Korea Atomic Energy Research Institute: Foreign trip report, June 14–20, 1992.** Riemke, R.A. EG and G Idaho, Inc., Idaho Falls, ID (United States). 21 Jul 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93014205. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report discusses travel requested by the Korea Atomic Energy Research Institute (KAERI) to present seminars and participate in discussion sessions relating to the RELAP/MOD3 code.

32912 (DOE/FTR–93014641) **Travel to Bulgaria to attend workshop on safety review and inspection in nuclear power plant operation: Foreign trip report, May 18–22, 1992.** Bickel, J.H. EG and G Idaho, Inc., Idaho Falls, ID (United States). 18 Jun 1992. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93014641. Source: OSTI; NTIS (US Sales Only); GPO Dep.

I participated in the Kozloduy workshop on safety review and inspection in nuclear power plant operation at the Kozloduy Nuclear Power Plant in Kozloduy, Bulgaria. The workshop was organized jointly by Argonne National Laboratory and the IAEA and funded by the USDOE and US Department of State as a part of a program to upgrade the operational safety of East European nuclear power plants.

32913 (DOE/FTR–93014686) **Travel to Germany and Russia to discuss radionuclide contamination of the Arctic, reactor safety, and plutonium deposition: Foreign trip report, July 16–25, 1992.** Dodd, L.R.; Shipp, B.D. Pacific Northwest Lab., Richland, WA (United States). 31 Aug 1992. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93014686. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The trip was hosted by Prof. Leonid Bolshov, Director, Institute of Nuclear Safety (INS), Russian Academy of Sciences. Meetings took place with INS staff, and representatives of the Ministry of Atomic Energy (MINATOM), GOSKOMCHERNOBN, GOSATOAFNADSOR, the Kurchatov Znstitute, NIKIET (Research and Development Institute of Power Engineering, Moscow), and the Supreme Soviet of the RSFR. Topics of discussion included radionuclide contamination of the Arctic, reactor safety, and plutonium disposition. An agreement in principal was reached between PNL and INS, in cooperation with the Kurchatov Institute, to work together in these general areas. Subsequently, formal requests have been received from MINATOM and GOSATOMNADSOR for PNL assistance in improving the safety of RBMK reactors and for converting the remaining graphite-moderated production reactors to civilian use.

32914 (DOE/FTR–93014812) **Third G-24 Nuclear Safety Working Group meeting in Brussels, Belgium: Foreign trip report, February 22–28, 1992.** Horton, K.E. (USDOE, Washington, DC (United States)); Morris, D.P. USDOE, Washington, DC (United States). 12 Mar 1992. 25p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93014812. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The travelers represented the Department of Energy at the third meeting of the G-24 Nuclear Safety Working Group for coordinating assistance to Eastern Europe held in Brussels, Belgium. The US Delegation also consisted of representatives from the US Agency for International Development, and the US Nuclear Regulatory Commission. The meeting convened on the morning of 24 February 1992 and included representatives from all member nations. The focus of the morning session surrounded the implementation of a data base, managed jointly by the Commission of the European Communities and the International Atomic Energy Agency, to track nuclear safety assistance programs in eastern Europe, in order to prevent duplication and conflicts. On 25 February 1992, a meeting was held at the offices of the US Mission to the European Community in Brussels between the Bulgarian and US Delegations to discuss the specific status of assistance programs to Bulgaria. DOE and NRC discussed specific programs and potential future activities with the Bulgarians that could improve the operational safety of the nuclear powerplants in Kozloduy. Wednesday, February 26, 1992, Mr. Horton and Mr. Morris met with senior officials of the Czechoslovak Atomic Energy Commission (CAEC) in Prague, CSFR (Czech/Slovak Federal Republic) to discuss nuclear safety assistance programs and a list of priorities set by the CAEC. The visit to the CSFR also included a brief discussion and demonstrations of emergency planning and response software at the Nuclear Research Institute in Rez.

32915 (DOE/SR/18035–T1-Vol.1) **New production reactor flow instability experiments with coolant upflow: Volume 1, Fuel assembly and test facility description.** Ohrn, T.T. (Babcock and Wilcox Co., Alliance, OH (United States). Research and Development Div.); Privette, R.M. Westinghouse Savannah River Co., Aiken, SC (United States); Babcock and Wilcox Co., Alliance, OH (United States). Research and Development Div. Apr 1992. 521p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93019364. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A full-scale model Mark 22 fuel assembly was tested in an upflow configuration under various simulated hypothetical reactor accident scenarios. The testing provided detailed fuel assembly thermal-hydraulic response during both full-power and decay-power transient and steady-state conditions. This volume details the model fuel assembly, LOCA and LHF test loops, power supply, instrumentation, control systems, and the data acquisition system. The goal is to provide the reader with a detailed description of the test hardware and to give the code analyst sufficient information to construct detailed numerical simulations of the test hardware and test procedures.

32916 (DOE/SR/18035–T1-Vol.2) **New production reactor flow instability experiments with coolant upflow: Volume 2, Test program and results.** Ohrn, T.R. (Babcock and Wilcox Co., Alliance, OH (United States). Research and Development Div.); Privette, R.M. Westinghouse Savannah River Co., Aiken, SC (United States); Babcock and Wilcox Co., Alliance, OH (United States). Research and Development Div. Apr 1992. 483p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93019365. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The New Production Reactor (NPR) Upflow program included two distinct test series: the full-power Loss-of-Coolant Accident (LOCA) loop tests and the decay-power Low Heat Flux (LHF) loop tests. The scope of the work performed by Babcock & Wilcox (B&W) under this contract included responsibility for the design and fabrication of the test facilities, test operation and data qualification, and documentation of test results. Data obtained during the test program has been forwarded to Westinghouse Savannah River Company (WSRC) for benchmarking of computer codes used in the design of the NPR. Copies of all data acquired during the test program are retained on file at the B&W Alliance Research Center. This volume, Volume 2, documents test data acquired during the test program.

32917 (EGG-M–93070) **Operating experience of natural circulation core cooling in boiling water reactors.** Kullberg, C.; Jones, K.; Heath, C. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1993]. 13p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-931121–15: Annual winter meeting of the American Society of Mechanical Engineers, New Orleans, LA (United States), 28 Nov - 3 dec 1993). Order Number DE93018997. Source: OSTI; NTIS; INIS; GPO Dep.

General Electric (GE) has proposed an advanced boiling water reactor, the Simplified Boiling Water Reactor (SBWR), which will utilize passive, gravity-driven safety systems for emergency core coolant injection. The SBWR design includes no recirculation loops or recirculation pumps. Therefore the SBWR will operate in a natural circulation (NC) mode at full power conditions. This design poses some concerns relative to stability during startup, shutdown, and at power conditions. As a consequence, the NRC has directed

personnel at several national labs to help investigate SBWR stability issues. This paper will focus on some of the preliminary findings made at the INEL. Because of the broad range of stability issues this paper will mainly focus on potential geysering instabilities during startup. The two NC designs examined in detail are the US Humboldt Bay Unit 3 BWR-1 plant and Dodewaard plant in the Netherlands. The objective of this paper will be to review operating experience of these two plants and evaluate their relevance to planned SBWR operational procedures. For completeness, experimental work with early natural circulation GE test facilities will also be briefly discussed.

32918 (EGG-PIR–10633(1Q-93)) **Performance indicators for 1st quarter CY 1993.** EG and G Idaho, Inc., Idaho Falls, ID (United States). 1993. 109p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93018931. Source: OSTI; NTIS; GPO Dep.

The Department of Energy (DOE) has established a Department-wide Performance Indicator (PI) Program for trending and analysis of operational data as directed by DOE Order 5480.26. The PI Program was established to provide a means for monitoring the environment, safety, and health (ES&H) performance of the DOE at the Secretary and other management levels. This is the ninth in a series of quarterly reports generated for the Department of Energy Field Office, Idaho (DOE-ID) by EG&G Idaho, Inc. to meet the requirements of the PI Program as directed by the DOE Standard. DOE-STD-1048-92 identifies four general areas of PIs. They are: Personnel Safety, Operational Incidents, Environment and Management. These four areas have been subdivided into 26 performance indicators. Approximately 115 performance indicator control and distribution charts comprise the body of this report A brief summary of PIs contained in each of these general areas is provided in the following pages. The four EG&G facilities whose performance is charted herein are as follows: (1) The Advanced Test Reactor (ATR); (2) The Radioactive Waste Management Complex (RWMC); (3) The Waste Experimental Reduction Facility (WERF) and (4) The Test Reactor Area (TRA) Hot Cells.

32919 (KFKI–1992-33/G) **Extension of the Paks full-scale simulator to severe accidents.** Vegh, E.; Janosy, J.S.; Ivancsics, P. Hungarian Academy of Sciences, Budapest (Hungary). Central Research Inst. for Physics. Nov 1992. 23p. (CONF-921068–: East-West topical meeting: the safe and reliable operation of light water reactor NPP's, Prague (Czechoslovakia), 18-21 Oct 1992). Order Number DE94600263. Source: OSTI; NTIS (US Sales Only); INIS.

In the present form the Paks full-scale simulator can be used only for the initial phase of LOCA transients. This simulator is currently being upgraded to simulate severe accidental situations in the primary circuit, such as core dryout, reflooding, fuel element rupture, ATWS events and control rod ejection. The upgrading is due to be finished in the first half of 1993. The main characteristics of the new models are described, a detailed nodalization scheme of the primary circuit is given, and the verification process of the simulator is presented. (author) 6 refs.; 7 figs.

32920 (LA–12387-M) **Nuclear criticality safety: 3-day training course.** Schlesser, J.A. (ed.). Los Alamos National Lab., NM (United States). Jun 1993. 164p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93018407. Source: OSTI; NTIS; INIS; GPO Dep.

The "3-Day Training Course" is an intensive course in criticality safety consisting of lectures and laboratory sessions, including active student participation in actual critical experiments, a visit to a plutonium processing facility, and in-depth discussions on safety philosophy. The program is directed toward personnel who currently have criticality safety responsibilities in the capacity of supervisory staff and/or line management. This compilation of notes is presented as a source reference for the criticality safety course. It represents the contributions of many people, particularly Tom McLaughlin, the course's primary instructor. It should be noted that when chapters were extracted, an attempt was made to maintain footnotes and references as originally written. Photographs and illustrations are numbered sequentially.

32921 (LA-SUB–93-230) **Leak-before-break Issue.** Los Alamos National Lab., NM (United States); ERC Environmental and Energy Services Co., Albuquerque, NM (United States). 5 May 1989. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93019302. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Light water reactors (LWRs) must be designed to accomodate loss of coolant accidents (LOCAs) up to and including a double-ended guillotine break (DEGB) of the largest pipe in the reactor coolant system. Advanced fracture mechanics technology [the leak-before-break (LBB) approach] has been used to demonstrate that there is a very low probability of DEGB in the kinds of piping used in many LWRs. Consequently, some licensing requirements have been relaxed. The issue with respect to new production reactor (NPR) design requirements is whether the LBB approach can be applied to NPR design concepts and whether there is justification for eliminating DEGB as a design basis accident. This paper recommends the following concerning NPR design criteria: Allow LBB analysis as a basis for eliminating pipe whip restraints and other supports designed to mitigate the loads for postulated ruptures in primary system piping; Not allow LBB analysis to eliminate the DEGB LOCA as a design basis accident for the emergency cooling system; and, Not allow LBB analysis to limit the design-basis accident (peak pressure and temperature) for containment and environmental qualifications.

32922 (LA-UR–93-1676) **One-dimensional TRAC calculations of a pump-trip scram for the PIUS 600 advanced reactor design.** Steiner, J.L.; Lime, J.F.; Elson, J.S.; Stumpf, H.J.; Boyack, B.E. Los Alamos National Lab., NM (United States). [1993]. 16p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-931160–3: American Nuclear Society (ANS) winter meeting, San Francisco, CA (United States), 14-19 Nov 1993). Order Number DE93014424. Source: OSTI; NTIS; INIS; GPO Dep.

One dimensional TRAC transient calculations of the process inherent ultimate safety (PIUS) advanced reactor design were performed for a pump-trip SCRAM. The TRAC calculations showed that the reactor power response and shutdown were in qualitative agreement with the one-dimensional analyses presented in the PIUS Preliminary Safety Information Document (PSID) submitted by Asea Brown Boveri (ABB) to the US Nuclear Regulatory Commission for preapplication safety review. The PSID analyses were performed with the ABB-developed RIGEL code. The TRAC-calculated phenomena and trends were also similar to those calculated with another one-dimensional PIUS model, the Brookhaven National Laboratory developed PIPA code. A TRAC pump-trip SCRAM transient has also been calculated with a TRAC model containing a multi-dimensional representation of the PIUS internal flow structures and core region. The results obtained using the TRAC fully one-dimensional PIUS model are compared to the RIGEL, PIPA, and TRAC multi-dimensional results.

32923 (NKS–93-1) **The Nordic programme for nuclear safety 1990-1993. Report for 1992.** Nordisk Kernesikkerhedsforskning, Roskilde (Denmark). Apr 1993. 76p. (In Danish, English, Norwegian, Swedish). Order Number DE94600189. Source: OSTI; NTIS; INIS.

The annual report contains the coordinators' summary of the results so far achieved by the in all 18 current projects in which 200 persons are taking part. In some cases the project leader's account is included. An overview is given of the programme's costs and orders during 1992 in relation to the subsidies given to the individual projects. The fields covered by these projects are emergency readiness in radiation situations which are not normal, nuclear wastes and their disposal, radioecology, reactor safety - knowledge readiness, and coordination efforts. An economical overview is given and English summaries of the projects presented at the summer meeting in 1992 are presented. A list of the names of the members of the Nordic Nuclear Safety Research members in the syndicate and reference groups is included in the publication, and a brief description is to be found of the institution's activities. (AB) (78 refs.).

32924 (NKS–93-2) **The Nordic programme for nuclear safety 1990-1993. Plan for 1993.** Nordisk Kernesikkerhedsforskning, Roskilde (Denmark). Apr 1993. 67p. (In Danish, Swedish, Norwegian, English). Order Number DE94600190. Source: OSTI; NTIS; INIS.

In 1993 the fourth Nordic Nuclear Safety Research programme will be concluded with final reports on all of the eighteen projects. Each report will contain the results of the work carried out which has taken four years to complete and, at the same time, give a more general survey of the Northern countries' competence within the fields of emergency readiness in situations of abnormal radiation, radioactive waste and its disposal, radioecology and nuclear reactor safety - accessibility of appropriate information. Some of the reports will be published in the form of reference books or in the form of databases of direct assistance to the authorities. A number of seminars will be held so that the results and professional level of the reports can be discussed. The coordinators' and project leaders' plans for these activities are presented with the the amounts of money that project organizers have asked the Nordic Nuclear Safety Research programme to finance them with. During 1993 the plans for the programme starting in 1994 must be laid, and future researchers, project leaders, involved organizations and sponsors determined. (AB).

32925 (NUREG–1463) **Regulatory analysis for the resolution of Generic Safety Issue 105: Interfacing system loss-of-coolant accident in light-water reactors.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Safety Issue Resolution. Jul 1993. 73p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

An interfacing systems loss of coolant accident (ISLOCA) involves failure or improper operation of pressure isolation valves (PIVs) that compose the boundary between the reactor coolant system and low-pressure rated systems. Some ISLOCAs can bypass containment and result in direct release of fission products to the environment. A cost/benefit evaluation, using three PWR analyses, calculated the benefit of two potential modifications to the plants. Alternative 1 is improved plant operations to optimize the operator's performance and reduce human error probabilities. Alternative 2 adds pressure sensing devices, cabling, and instrumentation between two PIVs to provide operators with continuous monitoring of the first PIV. These two alternatives were evaluated for the base case plants (Case 1) and for each plant, assuming the plants had a particular auxiliary building design in which severe flooding would be a problem if an ISLOCA occurred. The auxiliary building design (Case 2) was selected from a survey that revealed a number of designs with features that provided less than optimal resistance to ECCS equipment loss caused by a ISLOCA-induced environment. The results were judged not to provide sufficient basis for generic requirements. It was concluded that the most viable course of action to resolve Generic Issue 105 is licensee participation in individual plant examinations (IPEs).

32926 (NUREG/CR–3469-Vol.7) **Occupational dose reduction at nuclear power plants: Annotated bibliography of selected readings in radiation protection and ALARA: Volume 7.** Kaurin, D.G. (Brookhaven National Lab., Upton, NY (United States)); Khan, T.A.; Sullivan, S.G.; Baum, J.W. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Brookhaven National Lab., Upton, NY (United States). Jul 1993. 98p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC02-76CH00016. (BNL-NUREG–51708-Vol.7). Source: OSTI; INIS; NTIS; GPO.

The ALARA Center at Brookhaven National Laboratory publishes a series of bibliographies of selected readings in radiation protection and ALARA in the continuing effort to collect and disseminate information on radiation dose reduction at nuclear power plants. This is volume 7 of the series. The abstracts in this bibliography were selected from proceedings of technical meetings and conferences, journals, research reports, and searches of the Energy Science and Technology database of the US Department of Energy. The subject material of these abstracts relates to radiation protection and dose reduction, and ranges from use of robotics to operational health physics, to water chemistry. Material on the design, planning, and management of nuclear power stations is included, as well as information on decommissioning and safe storage efforts. Volume 7 contains 293 abstract, an author index, and a subject index. The author index is specific for this volume. The subject index is cumulative and lists all abstract numbers from volumes 1 to 7. The numbers in boldface indicate the abstracts in this volume; the numbers not in boldface represent abstracts in previous volumes.

32927 (NUREG/CR–5758-Vol.3) **Fitness for duty in the nuclear power industry: Volume 3, Annual summary of program performance reports, CY 1992.** Fleming, T. (Battelle Human Affairs Research Centers, Seattle, WA (US)); Westra, C.; Field, I.; Forslund, C.; Durbin, N.; Grant, T.; Moffitt, R. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Radiation Safety and Safeguards; Pacific Northwest Lab., Richland, WA (United States); Battelle Human Affairs Research Center, Seattle, WA (United States). Jul 1993. 112p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC06-76RL01830. (PNL–8688-Vol.3;BHARC–700/93/029-Vol.3). Source: OSTI; NTIS; INIS; GPO.

This report summarizes the data from the semi-annual reports on fitness-for-duty programs submitted to the NRC by 52 utilities for two reporting periods: January 1 through June 30, 1992, and July 1 through December 31, 1992. During 1992, licensees reported that they had conducted 266,551 tests for the presence of illegal drugs and alcohol. Of these test, 1,818 (.68%) were confirmed positive. Positive test results varied by category of test and category of worker. The majority of positive test results (1,110) were obtained through pre-access testing. Of tests conducted on workers having access to the protected area, there were 461 positive tests from random testing and 178 positive tests from for-cause testing. Follow-up testing of workers who had previously tested positive resulted in 69 positive tests. For-cause testing resulted in the highest percentage of positive-tests; about 26% of for-cause tests were positive. This compares to a positive test rate of 1.06 percent of pre-access tests and .29 percent of random tests. Positive test rates also varied by category of worker. Overall, short-term contractor personnel had the highest positive test rate at 1.00 percent. Licensee employees and long-term contractors had lower positive test rates (.29% and .63%, respectively). Of the substances tested, marijuana was responsible for the highest percentage of positive test results (50.3%), followed by cocaine (24.8%) and alcohol (22.6%). Positive test results are also reported for NRC administrative regions and for plants located in areas with different rates of population density.

32928 (NUREG/CR–5833) **Auxiliary feedwater system risk-based inspection guide for the H. B. Robinson nuclear power plant.** Moffitt, N.E. (Pacific Northwest Lab., Richland, WA (United States)); Lloyd, R.C.; Gore, B.F.; Vo, T.V.; Garner, L.W. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Systems Safety and Analysis; Pacific Northwest Lab., Richland, WA (United States). Aug 1993. 33p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC06-76RL01830. (PNL–7907). Source: OSTI; NTIS; INIS; GPO.

In a study sponsored by the US Nuclear Regulatory Commission (NRC), Pacific Northwest Laboratory has developed and applied a methodology for deriving plant-specific risk-based inspection guidance for the auxiliary feedwater (AFW) system at pressurized water reactors that have not undergone probabilistic risk assessment (PRA). This methodology uses existing PRA results and plant operating experience information. Existing PRA-based inspection guidance information recently developed for the NRC for various plants was used to identify generic component failure modes. This information was then combined with plant-specific and industry-wide component information and failure data to identify failure modes and failure mechanisms for the AFW system at the selected plants. H. B. Robinson was selected as one of a series of plants for study. The product of this effort is a prioritized listing of AFW failures which have occurred at the plant and at other PWRs. This listing is intended for use by NRC inspectors in the preparation of inspection plans addressing AFW risk-important components at the H. B. Robinson plant.

32929 (NUREG/CR–6023) **Generic analyses for evaluation of low Charpy upper-shelf energy effects on safety margins against fracture of reactor pressure vessel materials.** Dickson, T.L. (Oak Ridge National Lab., TN (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Div. of

Engineering; Oak Ridge National Lab., TN (United States). Jul 1993. 72p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/TM–12340). Source: OSTI; NTIS; INIS; GPO.

Appendix G to 10 CFR Part 50 requires that reactor pressure vessel beltline material maintain Charpy upper-shelf energies of no less than 50 ft-lb during the plant operating life, unless it is demonstrated in a manner approved by the Nuclear Regulatory Commission (NRC), that lower values of Charpy upper-shelf energy provide margins of safety against fracture equivalent to those in Appendix G to Section XI of the ASME Code. Analyses based on acceptance criteria and analysis methods adopted in the ASME Code Case N-512 are described herein. Additional information on material properties was provided by the NRC, Office of Nuclear Regulatory Research, Materials Engineering Branch. These cases, specified by the NRC, represent generic applications to boiling water reactor and pressurized water reactor vessels. This report is designated as HSST Report No. 140.

32930 (NUREG/CR–6049) **Piping benchmark problems for the General Electric Advanced Boiling Water Reactor.** Bezler, P. (Brookhaven National Lab., Upton, NY (US)); DeGrassi, G.; Braverman, J.; Wang, Y.K. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Engineering; Brookhaven National Lab., Upton, NY (United States). Aug 1993. 251p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC02-76CH00016. (BNL-NUREG–52377). Source: OSTI; NTIS; INIS; GPO.

To satisfy the need for verification of the computer programs and modeling techniques that will be used to perform the final piping analyses for an advanced boiling water reactor standard design, three benchmark problems were developed. The problems are representative piping systems subjected to representative dynamic loads with solutions developed using the methods being proposed for analysis for the advanced reactor standard design. It will be required that the combined license holders demonstrate that their solutions to these problems are in agreement with the benchmark problem set.

32931 (NUREG/CR–6052) **Methodology for reliability based condition assessment: Application to concrete structures in nuclear plants.** Mori, Y. (Johns Hopkins Univ., Baltimore, MD (US). Dept. of Civil Engineering); Ellingwood, B. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Engineering; Oak Ridge National Lab., TN (United States); Johns Hopkins Univ., Baltimore, MD (United States). Dept. of Civil Engineering. Aug 1993. 150p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. (ORNL/Sub–93-SD684). Source: OSTI; NTIS; INIS; GPO.

Structures in nuclear power plants may be exposed to aggressive environmental effects that cause their strength to decrease over an extended period of service. A major concern in evaluating the continued service for such structures is to ensure that in their current condition they are able to withstand future extreme load events during the intended service life with a level of reliability sufficient for public safety. This report describes a methodology to facilitate quantitative assessments of current and future structural reliability and performance of structures in nuclear power plants. This methodology takes into account the nature of past and future loads, and randomness in strength and in degradation resulting from environmental factors. An adaptive Monte Carlo simulation procedure is used to evaluate time-dependent system reliability. The time-dependent reliability is sensitive to the time-varying load characteristics and to the choice of initial strength and strength degradation models but not to correlation in component strengths within a system. Inspection/maintenance strategies are identified that minimize the expected future costs of keeping the failure probability of a structure at or below an established target failure probability during its anticipated service period.

32932 (NUREG/CR–6079) **Seismological investigation of earthquakes in the New Madrid Seismic Zone: Final report, September 1986–December 1992.** Herrmann, R.B. (Saint Louis Univ., MO (US). Dept. of Earth and Atmospheric Sciences); Nguyen, B. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Engineering; Saint Louis Univ., MO (United States). Dept. of Earth and Atmospheric Sciences. Aug 1993. 63p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Contract NRC-04-86-121. Source: OSTI; NTIS; INIS; GPO.

Earthquake activity in the New Madrid Seismic Zone had been monitored by regional seismic networks since 1975. During this time period, over 3,700 earthquakes have been located within the region bounded by latitudes 35°–39°N and longitudes 87°–92°W. Most of these earthquakes occur within a 1.5° x 2° zone centered on the Missouri Bootheel. Source parameters of larger earthquakes in the zone and in eastern North America are determined using surface-wave spectral amplitudes and broadband waveforms for the purpose of determining the focal mechanism, source depth and seismic moment. Waveform modeling of broadband data is shown to be a powerful tool in defining these source parameters when used complementary with regional seismic network data, and in addition, in verifying the correctness of previously published focal mechanism solutions.

32933 (NUREG/CR–6082) **Data communications.** Preckshot, G.G. (Lawrence Livermore National Lab., CA (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Div. of Reactor Controls and Human Factors; Lawrence Livermore National Lab., CA (United States). Aug 1993. 86p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract W-7405-ENG-48. (UCRL-ID–114567). Source: OSTI; NTIS; INIS; GPO.

The purpose of this paper is to recommend regulatory guidance for reviewers examining computer communication systems used in nuclear power plants. The recommendations cover three areas important to these communications systems: system design, communication protocols, and communication media. The first area, system design, considers three aspects of system design–questions about architecture, specific risky design elements or omissions to look for in designs being reviewed, and recommendations for multiplexed data communication systems used in safety systems. The second area reviews pertinent aspects of communication protocol design and makes recommendations for newly designed protocols or the selection of existing protocols for safety system, information display, and non-safety control system use. The third area covers communication media selection, which differs significantly from traditional wire and cable. The recommendations for communication media extend or enhance the concerns of published IEEE standards about three subjects: data rate, imported hazards and maintainability.

32934 (NUREG/CR–6083) **Reviewing real-time performance of nuclear reactor safety systems.** Preckshot, G.G. (Lawrence Livermore National Lab., CA (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Div. of Reactor Controls and Human Factors; Lawrence Livermore National Lab., CA (United States). Aug 1993. 79p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract W-7405-ENG-48. (UCRL-ID–114565). Source: OSTI; NTIS; INIS; GPO.

The purpose of this paper is to recommend regulatory guidance for reviewers examining real-time performance of computer-based safety systems used in nuclear power plants. Three areas of guidance are covered in this report. The first area covers how to determine if, when, and what prototypes should be required of developers to make a convincing demonstration that specific problems have been solved or that performance goals have been met. The second area has recommendations for timing analyses that will prove that the real-time system will meet its safety-imposed deadlines. The third area has description of means for assessing expected or actual real-time performance before, during, and after development is completed. To ensure that the delivered real-time software product meets performance goals, the paper recommends certain types of code-execution and communications scheduling. Technical background is provided in the appendix on methods of timing analysis, scheduling real-time computations, prototyping, real-time software development approaches, modeling and measurement, and real-time operating systems.

32935 (NUREG/IA–0085) **Assessment of full power turbine trip start-up test for C. Trillo 1 with RELAP5/MOD2: International Agreement Report.** Lozano, M.F. (Consejo de Seguridad Nuclear, Madrid (Spain)); Moreno, P.; de la Cal, C.; Larrea, E.; Lopez, A.; Santamaria, J.G.; Lopez, E.; Novo, M. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research; Consejo de Seguridad Nuclear, Madrid (Spain). Jul 1993. 60p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). (ICSP–TR-TTRIP-R). Source: OSTI; NTIS; INIS; GPO.

Prepared as part of the Agreement on Research Participation and Technical Exchange under the International Thermal-Hydraulic Code Assessment and Application Program (ICAP).

C. Trillo I has developed a model of the plant with RELAP5/MOD2/36.04. This model will be validated against a selected set of start-up tests. One of the transients selected to that aim is the turbine trip, which presents very specific characteristics that make it significantly different from the same transient in other PWRs of different design, the main difference being that the reactor is not tripped: a reduction in primary power is carried out instead. Pretest calculations were done of the Turbine Trip Test and compared against the actual test. Minor problems in the first model, specially in the Control and Limitation Systems, were identified and post-test calculations had been carried out. The results show a good agreement with data for all the compared variables.

32936 (NUREG/IA–0091) **Assessment of RELAP5/MOD2 against a natural circulation experiment in Nuclear Power Plant Borssele: International Agreement Report.** Winters, L. (Netherlands Energy Research Foundation (ECN), Petten (Netherlands)). Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research; Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Jul 1993. 56p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). (ECN–89-91). Source: OSTI; NTIS (documentation only); ESTSC (complete software package), P.O. Box 1020, Oak Ridge, TN 37831-1020; GPO; INIS.

Prepared as part of the Agreement on Research Participation and Technical Exchange under the International Thermal-Hydraulic Code Assessment and Application Program (ICAP).

As part of the ICAP (International Code Assessment and Applications Program) agreement between ECN (Netherlands Energy Research Foundation) and USNRC, ECN has performed a number of assessment calculations for the thermohydraulic system analysis code RELAP5/MOD2/36.05. This document describes the assessment of this computer program versus a natural circulation experiment as conducted at the Borssele Nuclear Power Plant. The results of this comparison show that the code RELAP5/MOD2 predicts well the natural circulation behaviour of Nuclear Power Plant Borssele.

32937 (NUREG/IA–0103) **Assessment of BETHSY Test 9.1.b using RELAP5/MOD3: International Agreement Report.** Lee, S. (Korea Inst. of Nuclear Safety, Taejon (Korea, Republic of)); Chung, B.D.; Kim, H.J. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research; Korea Inst. of Nuclear Safety, Taejon (Korea, Republic of). Jun 1993. 235p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

Prepared as part of the Agreement on Research Participation and Technical Exchange under the International Thermal-Hydraulic Code Assessment and Application Program (ICAP).

The 2" cold leg break test 9.I.b, conducted at the BETHSY facility was analyzed using the RELAP5/MOD3 Version 5m5 code. The test 9.I.b was conducted with the main objective being the investigation of the thermal-hydraulic mechanisms responsible for the large core uncovery and fuel heat-up, requiring the implementation of an ultimate procedure. The present analysis demonstrates the code's capability to predict, with sufficient accuracy, the main phenomena occurring in the depressurization transient, both from a qualitative and quantitative point of view. Nevertheless, several differences regarding the evolution of phenomena and affecting the timing order have to be pointed out in the base calculation. Three calculations were carried out to study the sensitivity to change of the nodalization in the components of the loop seal cross-over legs, and of the auxiliary feedwater control logics, and of the break discharge coefficient.

32938 (NUREG/IA–0112) **Assessment of RELAP5/MOD2 against ECN-reflood experiments: International Agreement Report.** Woudstra, A. (Netherlands Energy Research Foundation (ECN), Petten (Netherlands)); Van De Bogaard, J.P.A.; Stoop, P.M. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research; Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Jul 1993. 83p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). (ECN-C–92-008). Source: OSTI; NTIS; INIS; GPO.

Prepared as part of the agreement on research participation and technical exchange under the International Thermal-Hydraulic Code Assessment and Application Program (ICAP).

As part of the ICAP (International Code Assessment and Applications Program) agreement between ECN (Netherlands Energy Research Foundation) and USNRC, ECN has performed a number of assessment calculations with the computer program RELAP5. This report describes the results as obtained by ECN from the assessment of the thermohydraulic computer program RELAP5/MOD2/CY 36.05 versus a series of reflood experiments in a bundle geometry. A total number of seven selected experiments have been analyzed, from the reflood experimental program as previously conducted by ECN under contract of the Commission of the European Communities (CEC). In this document, the results of the analyses are presented and a comparison with the experimental data is provided.

32939 (NUREG/IA–0127) **Reactor safety issues resolved by the 2D/3D Program: International Agreement Report.** Damerell, P.S. (MPR Associates, Inc., Washington, DC (United States)); Simons, J.W. (eds.). Nuclear Regulatory Commission, Washington, DC (United States); Japan Atomic Energy Research Inst., Tokyo (Japan); Gesellschaft fuer Anlagen- und Reaktorsicherheit (GRS) mbH, Koeln (Gemany); Siemens AG Unternehmensbereich KWU, Erlangen (Germany); Los Alamos National Lab., NM (United States); MPR Associates, Inc., Washington, DC (United States). Jul 1993. 395p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). (GRS–101;MPR–1346). Source: OSTI; NTIS; INIS; GPO.

Prepared as part of Arrangement on Research Participation and Technical Exchange between the Federal Minister for Research and Technology of the Federal Republic of Germany, Japan Atomic Energy Research Institute and the US Nuclear Regulatory Commission.

The 2D/3D Program studied multidimensional thermal-hydraulics in a PWR core and primary system during the end-of-blowdown and post-blowdown phases of a large-break LOCA (LBLOCA), and during selected small-break LOCA (SBLOCA) transients. The program included tests at the Cylindrical Core Test Facility (CCTF), the Slab Core Test Facility (SCTF), and the Upper Plenum Test Facility (UPTF), and computer analyses using TRAC. Tests at CCTF investigated core thermal-hydraulics and overall system behavior while tests at SCTF concentrated on multidimensional core thermal-hydraulics. The UPTF tests investigated two-phase flow behavior in the downcomer, upper plenum, tie plate region, and primary loops. TRAC analyses evaluated thermal-hydraulic behavior throughout the primary system in tests as well as in PWRs. This report summarizes the test and analysis results in each of the main areas where improved information was obtained in the 2D/3D Program. The discussion is organized in terms of the reactor safety issues investigated.

32940 (ORNL/TM–12215) **Analysis of HFIR pressurizer pump overspeed transients and relief valve performance.** Sozer, M.C. Oak Ridge National Lab., TN (United States). 11 Sep 1992. 116p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93019222. Source: OSTI; NTIS; GPO Dep.

The pressurizer pump overspeed transients at the High Flux Isotope Reactor (HFIR) fall in the category of "increase in coolant inventory transients." They are among the accident transients to be performed for Chapter 15 of the HFIR safety analysis report (SAR). The pressurizer pump speed starting to increase inadvertently to reach its maximum speed of 3,560 rpm while the reactor operates

under normal conditions is the cause of this transient. Increased primary coolant system pressure due to increased pressurizer pump flow into the primary coolant head tank challenges the relief valves to open. If the relief valves do not open, increased primary coolant system pressure will challenge the integrity of the high pressure boundary. Two sets of analyses were performed to analyze the pressurizer pump overspeed transients. The purpose of the first analysis is to estimate how long it will take for the relief valves to open under different conditions and whether or not they will chatter or flutter for a considerable amount of time. The analysis estimates relief valve performance and stability using four different relief valve subsystem models. The relief valve subsystem models are not attached to the primary coolant system model. Vigorous pressure oscillations were produced in all of the computations performed as part of the first analysis. The second analysis includes new simulations of the pressurizer pump overspeed transients that were previously simulated using the RELAP5 thermal-hydraulic computer code. The HFIRSYS, High Flux Isotope Reactor System Transient Analysis computer code, was utilized for these simulations providing referable results for comparisons. The increased pressurizer pump flow due to runaway pressurizer pump speed pressurizes the primary coolant system. The assumptions were made in such a way to form constraining conditions at initiation of and during the transients to generate as high an overpressure situation as possible.

32941 (PNL-SA-21788) **United States experience in probabilistic risk assessment for a graphite moderated, channel reactor.** Heaberlin, S.W. (Pacific Northwest Lab., Richland, WA (US)); Zentner, M.D. Pacific Northwest Lab., Richland, WA (United States). Jun 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9306189–3: NE '93: 4th annual scientific and technical conference of the Nuclear Society: nuclear energy and human safety, Nizhni Novgorod (Russian Federation), 28 Jun - 2 jul 1993). Order Number DE93017662. Source: OSTI; NTIS; INIS; GPO Dep.

The United States operated a number of graphite moderated, water cooled, pressure tube (or channel type) reactors at the Hanford Site in Washington State. The last of these reactors to operate was the Hanford N Reactor which was designed to produce steam for the generation of electricity for civilian energy use as well as special nuclear material. In 1982, a review team recommended that a probabilistic risk assessment (PRA) be conducted for the reactor. The basis for this recommendation was that the reactor represented a unique facility and therefore the safety insights gained from operations at other facilities were not directly transferable to it. Furthermore, the reactor was going through a series of upgrades and it was felt that the selection of competing improvements would benefit from a risk perspective to help judge the relative value of these upgrades. The initial Level 1 PRA was initiated just prior to the time of the Chernobyl accident in 1986. After the accident, a limited scope PRA was also conducted. The limited scope PRA was completed in July 1987. The original Level 1 PRA was brought to completion in August 1988 and was followed by complete Level 3 analyses including an evaluation of external initiating events. This paper will focus on the Level 1 effort. The objectives of the Level 1 PRA for N Reactor were: identification of the plant features that are the most important contributors to fuel-damage frequency; development of plant logic models for use in analyzing safety and reliability issues; identification of dominant accident sequences and their frequencies for input into the Level 2/3 PRA and external events analyses; and establishment of a Hanford team with demonstrable expertise in performing risk and reliability analyses.

32942 (SAND–90-0119) **Insights into the behavior of nuclear power plant containments during severe accidents.** Horschel, D.S. (Sandia National Labs., Albuquerque, NM (United States)); Ludwigsen, J.S.; Parks, M.B.; Lambert, L.D.; Dameron, R.A.; Rashid, Y.R. Sandia National Labs., Albuquerque, NM (United States). Jun 1993. 77p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (NPRW-CON–90-1). Order Number DE93018678. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The containment building surrounding a nuclear reactor offers the last barrier to the release of radioactive materials from a severe accident into the environment. The loading environment of the containment under severe accident conditions may include much greater than design pressures and temperatures. Investigations into the performance of containments subject to ultimate or failure pressure and temperature conditions have been performed over the last several years through a program administered by the Nuclear Regulatory Commission (NRC). These NRC sponsored investigations are subsequently discussed. Reviewed are the results of large scale experiments on reinforced concrete, prestressed concrete, and steel containment models pressurized to failure. In conjunction with these major tests, the results of separate effect testing on many of the critical containment components; that is, aged and unaged seals, a personnel air lock and electrical penetration assemblies subjected to elevated temperature and pressure have been performed. An objective of the NRC program is to gain an understanding of the behavior of typical existing and planned containment designs subject to postulated severe accident conditions. This understanding has led to the development of experimentally verified analytical tools that can be applied to accurately predict their ultimate capacities useful in developing severe accident mitigation schemes. Finally, speculation on the response of containments subjected to severe accident conditions is presented.

32943 (SAND–91-0252) **Experimental investigation of pressure and blockage effects on combustion limits in H_2-air-steam mixtures.** Sherman, M.P. (Sandia National Labs., Albuquerque, NM (United States)); Berman, M.; Beyer, R.F. Sandia National Labs., Albuquerque, NM (United States). Jun 1993. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93017943. Source: OSTI; NTIS; INIS; GPO Dep.

Experiments with hydrogen-air-steam mixtures, such as those found within a containment system following a reactor accident, were conducted in the Heated Detonation Tube (43 cm diameter and 12 m long) to determine the region of benign combustion; i.e., the region between the flammability limits and the deflagration-to-detonation transition limits. Obstacles were used to accelerate the flame; these include 30% blockage ratio annular rings, and alternate rings and disks of 60% blockage ratio. The initial conditions were 110 °C and one or three atmospheres pressure. A benign burning region exists for rich mixtures, but is generally smaller than for lean mixtures. Effects of the different obstacles and of the different pressures are discussed.

32944 (SAND–92-1827) **The calculation and application of quantitative risk goals for nuclear facilities.** Wyss, G.D. Sandia National Labs., Albuquerque, NM (United States). Jun 1993. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93040202. Source: OSTI; NTIS (US Sales Only); GPO Dep.

For several years the commercial nuclear power industry has used quantitative risk goals as a tool for measuring the societal risks posed by various reactor facilities. In 1990, the United States Department of Energy (DOE), Office of New Production Reactors, specified that new production reactor (NPR) facilities will "have a level of safety assurance that meets or exceeds that afforded the public by modern commercial nuclear power plants". To support this policy, Sandia National Laboratories undertook a study of the numerous existing and proposed quantitative risk goals for reactor facilities. Although the NPR program has recently been deferred, the insights and recommendations that have emerged from the Sandia study are believed to be of general validity and interest because they can be used to provide insight and guidance in the appropriate use of risk-based goals for many types of nuclear facilities. This report examines the risk-based safety goals currently used by the US Nuclear Regulatory Commission (NRC), their scope, their assumptions, and how the risk calculations they specify are typically done. The report also demonstrates that the quantitative risk values calculated for two seemingly similar risk goals may vary widely based on the calculational assumptions used. It then makes specific recommendations regarding the formulation and calculation of risk goals for new nuclear facility designs that will make the quantitative risk values calculated for them

most directly comparable to those currently calculated under existing NRC guidance for commercial nuclear power plants.

32945 (SAND–92-2863) **MELCOR 1.8.1 calculations of ISP31: The CORA-13 experiment.** Gross, R.J.; Thompson, S.L.; Martinez, G.M. Sandia National Labs., Albuquerque, NM (United States). Jun 1993. 227p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018504. Source: OSTI; NTIS; INIS; GPO Dep.

The MELCOR code was used to simulate one of GRS's (a reactor research group in Germany) core degradation experiments conducted in the CORA out-of-pile test facility. This test, designated CORA-13, was selected as one of the International Standard Problems, Number ISP31, by the Organization for Economic Cooperation and Development. In this blind calculation, only initial and boundary conditions were provided. The experiment consisted of a small core bundle of twenty-five PWR fuel elements that was electrically heated to temperatures greater than 2,800 K. The experiment composed three phases: a 3,000 second gas preheat phase, an 1,870 second transient phase, and a 180 second water quench phase. MELCOR predictions are compared both to the experimental data and to eight other ISP31 submittals. Temperatures of various components, energy balance, zircaloy oxidation, and core blockage are examined. Up to the point where oxidation was significant, MELCOR temperatures agreed very well with the experiment – usually to within 50 K. MELCOR predicted oxidation to occur about 100 seconds earlier and at a faster rate than experimental data. The large oxidation spike that occurred during quench was not predicted. However, the experiment produced 210 grams of hydrogen, while MELCOR predicted 184 grams, which was one of the closest integral predictions of the nine submittals. Core blockage was of the right magnitude; however, material collected on the lower grid spacer in the experiment at an axial location of 450 mm, while in MELCOR the material collected at the 50 to 150 mm location. In general, compared to the other submittals, the MELCOR calculation was superior.

32946 (WSRC-MS–93-025) **The consequences of expansion joint bellows failure.** Miller, R.F.; Daugherty, W.L. Westinghouse Savannah River Co., Aiken, SC (United States). 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-930702–49: Pressure vessels and piping conference, Denver, CO (United States), 25-29 Jul 1993). Order Number DE93018769. Source: OSTI; NTIS; INIS; GPO Dep.

Expansion joint (EJ) bellows are thin walled, flexible components of a piping system. As such, they usually are the weakest structural link in the pressure boundary from a failure probability perspective. Previously, a 360°, circumferential rupture of a bellows was conservatively assumed to cause bellows collapse due to internal pressure resulting in a double-ended guillotine break (DEGB) and the associated, large leak rate. A finite element analysis was performed to determine the structural response of a ruptured bellows and its ability to resist large opening areas and hence, large leak rates. The results show that a 360° break can lead to an opening width of up to 0.7 inch following an instantaneous rupture – provided the equalizing rings and tie rods remain intact. This would result in an initial leak rate reduction equal to 80% of the previously assumed DEGB flow. The reduced flow rate is less than the water removal system capacity-assuring that flooding will not occur.

32947 (WSRC-MS–93-178) **A model of the control rod housing overflow incident in a Savannah River Production Reactor.** Shadday, M.A. Jr.; Flach, G.P.; Steimke, J.L.; Koffman, L.D.; Askew, N.M. Westinghouse Savannah River Co., Aiken, SC (United States). [1993]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-931160–2: American Nuclear Society (ANS) winter meeting, San Francisco, CA (United States), 14-19 Nov 1993). Order Number DE93013572. Source: OSTI; NTIS; GPO Dep.

On May 25, 1992, K-reactor at the Savannah River Site was being configured for start up when a D20 leak of unknown origin was detected on the top of the reactor. The reactor was immediately shutdown, and reactor start up was put on hold until the cause of the leak was determined and the problem eliminated. The source of the leak was suspected to be overflow of the control rod guide tubes, and on May 27 hydraulic tests in the laboratory confirmed this and identified the cause to be unanticipated secondary circulations in the control rod housings. The modelling effort, that in conjunction with the experimental program, identified a temporary fix that allowed K-reactor to be restarted two weeks after the initial overflow incident is herein described.

32948 (WSRC-RP–92-426) **A review of vapor explosion information pertinent to the SRS reactors.** Hyder, M.L.; Allison, D.K. Westinghouse Savannah River Co., Aiken, SC (United States). Apr 1992. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93019478. Source: OSTI; NTIS; INIS; GPO Dep.

Vapor explosions are explosive events resulting from the mixing of two liquids, one of which is heated to a temperature well above the boiling point of the second. Under some circumstances mixing of the liquids can boil part of the lower boiling liquid so quickly that the expanding vapor generates a strong pressure wave and explosion. If the lower boiling liquid is water, as is frequently the case, the event is called a "steam explosion". Analyses in support of the K-Reactor Probabilistic Risk Assessment have shown that steam explosions generated by the interaction of molten reactor fuel with water contribute significantly to the risk of reactor operation at the SRS. This calculated risk incorporates a conservative treatment of the uncertainties associated with such explosions. Study of steam explosions involving molten reactor materials has been included in the Severe Accident Analysis Program (SAAP) in order to obtain a better evaluation of their importance, and, if possible, to find ways to avoid them. This paper presents a brief review and summary of steam explosion experience from literature accounts, along with the results of experimental studies from the SAAP. It concludes with an evaluation of current knowledge, and suggestions for future development. 71 refs.

32949 (WSRC-RP–92-656) **K-FIX(GT): A computer program for modeling the expansion phase of steam explosions within complex three dimensional cavities.** Hyder, M.L. (Westinghouse Savannah River Co., Aiken, SC (United States)); Farawila, Y.M.; Abdel-Khalik, S.I.; Halvorson, P.J. Westinghouse Savannah River Co., Aiken, SC (United States). May 1992. 63p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93018977. Source: OSTI; NTIS; INIS; GPO Dep.

In the development of the Severe Accident Analysis Program for the Savannah River production reactors, it was recognized that certain accidents have the potential for causing damaging steam explosions. The massive SRS reactor buildings are likely to withstand any imaginable steam explosion. However, reactor components and building structures including hatches, ventilation ducts, etc., could be at risk if such an explosion occurred. No tools were available to estimate the effects of such explosions on actual structures. To meet this need, the Savannah River Laboratory contracted with the Georgia Institute of Technology Research Institute for development of a computer-based calculational tool for estimating the effects of steam explosions. The goal for this study was to develop a computer code that could be used parametrically to predict the effects of various steam explosions on their surroundings. This would be able to predict whether a steam explosion of a given magnitude would be likely to fail a particular structure. This would require, of course, that the magnitude of the explosion be specified through some combination of judgment and calculation. The requested code, identified as the K-FIX(GT) code, was developed and delivered by the contractor, along with extensive documentation. The several individual reports that constitute the documentation are each being issued as a separate WSRC report. Documentation includes several model calculations, and representation of these in graphic form. This report gives detailed instructions for the use of the code, including identification of all input parameters required.

32950 (WSRC-RP–93-498) **Radmodl Modeling Manual.** Murphy, S.L.; Stevens, K.A.; Weister, T.E. Westinghouse Savannah River Co., Aiken, SC (United States). Apr 1993. 211p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93019274. Source: OSTI; NTIS; GPO Dep.

RADMODL is a set of computer codes that model the transport of material through a network of interconnected compartments. This version of RADMODL is designed to model the transport of radioactive material from either a loss of coolant accident (LOCA) or a fuel handling accident into a set of interconnected compartments and determine the equivalent dose each compartment will see for the duration of the accident. The code is flexible enough to allow modeling of other types of materials and their dilution/dispersion during transport by designing a new set of input files corresponding to the facility layout and the dilution/dispersion factors. This report documents the issuance of the Modeling Manual, originally developed by EGS Corporation and ISSI as volume 1 of the Programmer's Manual, with the incorporation of minor editorial comments. Though a Modeling Manual in itself is not required for the RADMODL code certification, this manual does contain information that is required for the one of the requirements for code User's Manual and hence certification.

32951 (WSRC-TR–91-372-Rev.1) **GAM-HEAT – a computer code to compute heat transfer in complex enclosures: Revision 1.** Cooper, R.E.; Taylor, J.R.; Kielpinski, A.L.; Steimke, J.L. Westinghouse Savannah River Co., Aiken, SC (United States). Feb 1991. 52p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93019280. Source: OSTI; NTIS; INIS; GPO Dep.

The GAM-HEAT code was developed for heat transfer analyses associated with postulated Double Ended Guillotine Break Loss Of Coolant Accidents (DEGB LOCA) resulting in a drained reactor vessel. In these analyses the gamma radiation resulting from fission product decay constitutes the primary source of energy as a function of time. This energy is deposited into the various reactor components and is re- radiated as thermal energy. The code accounts for all radiant heat exchanges within and leaving the reactor enclosure. The SRS reactors constitute complex radiant exchange enclosures since there are many assemblies of various types within the primary enclosure and most of the assemblies themselves constitute enclosures. GAM-HEAT accounts for this complexity by processing externally generated view factors and connectivity matrices, and also accounts for convective, conductive, and advective heat exchanges. The code is applicable for many situations involving heat exchange between surfaces within a radiatively passive medium. The GAM-HEAT code has been exercised extensively for computing transient temperatures in SRS reactors with specific charges and control components. Results from these computations have been used to establish the need for and to evaluate hardware modifications designed to mitigate results of postulated accident scenarios, and to assist in the specification of safe reactor operating power limits. The code utilizes temperature dependence on material properties. The efficiency of the code has been enhanced by the use of an iterative equation solver. Verification of the code to date consists of comparisons with parallel efforts at Los Alamos National Laboratory and with similar efforts at Westinghouse Science and Technology Center in Pittsburgh, PA, and benchmarked using problems with known analytical or iterated solutions. All comparisons and tests yield results that indicate the GAM-HEAT code performs as intended.

32952 (WSRC-TR–92-11) **Heat exchanger staybolt acceptance criteria: Task number: 90-058-1.** Lam, P.S.; Sindelar, R.L.; Barnes, D.M. Westinghouse Savannah River Co., Aiken, SC (United States). Feb 1992. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93018181. Source: OSTI; NTIS; INIS; GPO Dep.

The structural integrity demonstration of the primary coolant piping system includes evaluating the structural capacity of each component against a large break or equivalent Double-Ended Guillotine Break. A large break at the inlet or outlet heads of the heat exchangers would occur if the restraint members of the heads become inactive. The structural integrity of the heads is demonstrated by showing the redundant capacity of the staybolts to restrain the head at design conditions and under seismic loadings. The Savannah River Site heat exchanger head is attached to the tubesheet by 84 staybolts. Access to the staybolts is limited due to a welded seal cap over the staybolts. An ultrasonic testing (UT) inspection technique to provide an in-situ examination of the staybolts has recently been developed at SRS. Examination of the staybolts will be performed to ensure their service condition and configuration is within acceptance limits. An acceptance criteria methodology has been developed to disposition flaws reported in the staybolt inspections while ensuring adequate restraint capacity of the staybolts to maintain integrity of the heat exchanger heads against collapse. The methodology includes an approach for the baseline and periodic inspections of the staybolts. The heat exchanger head is analyzed with a three-dimensional finite element model. The restraint provided by the staybolts is evaluated for several postulated cases of inactive or missing staybolts. Evaluation of specific, inactive staybolt configurations based on the UT results can be performed with the finite element model and fracture methodology in this report.

32953 (WSRC-TR–92-45) **Four foot septifoil cooling experiment unrestricted inlet/outlet case.** Foti, D.J.; Randolph, H.W.; Geiger, G.T.; Verebelyi, D.T.; Wooten, L.A. Westinghouse Savannah River Co., Aiken, SC (United States). Feb 1992. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93018261. Source: OSTI; NTIS; INIS; GPO Dep.

The ability to predict the behavior of reactor components to varying coolant flow scenarios constitutes a necessary skill for assessing reactor safety. One tool for performing these calculations is the Transient Reactor Analysis Code (TRAC). In order to benchmark the code, the Safety Analysis Group of SRL requested the Equipment Engineering Section (EES) of SRL to conduct a series of experiments to provide measurements of cooling parameters in a well defined physical system utilizing SRS reactor components. The configuration selected consisted of a short length of septifoil with both top and bottom fittings containing five simulated control rods in an "unseated" configuration. Varying power levels were to be supplied to the rods with 3.5 kilowatts per foot the value targeted for modelling during the computer runs. The septifoil segment was to be operated with no forced flow in order to evaluate thermal-hydraulic cooling. Parameters to be measured for comparison with code predictions were basic cooling phenomena, incidence of film boiling, water flow rate, pressure rise, and ratio of heat transfer through the wall of the assembly vs. heat transfer to axial water flow through the assembly. This report documents testing done with unimpeded flow into and out of the septifoil in order to assess basic cooling phenomena, incidence of film boiling and pressure rise. Previous tests have evaluated water flow rate and the ratio of axial to azimuthal heat transfer.

32954 (WSRC-TR–92-100-9) **Savannah River Technology Center monthly report, September 1992.** Ferrell, J.M. (comp.). Westinghouse Savannah River Co., Aiken, SC (United States). Sep 1992. 67p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93018192. Source: OSTI; NTIS; GPO Dep.

This is a monthly progress report from the Savannah River Laboratory for the month of September, 1992. It has sections dealing with work in the broad areas of reactor safety, tritium processes and absorption, separations programs and wastes, environmental concerns and responses, waste management practices, and general concerns.

32955 (WSRC-TR–93-101) **Analysis of SPRIHTE LOPA flow excursion tests.** Laurinat, J.E. Westinghouse Savannah River Co., Aiken, SC (United States). Feb 1993. 77p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93018191. Source: OSTI; NTIS; GPO Dep.

The SPRIHTE FLOPA flow excursion tests, the results of which are presented here, have been modeled using FLOPA, the assembly thermal-hydraulics limits analysis code for the LOPA. FLOPA calculations show $T_{wall} = T_{sat}$ is a reliable precursor to the onset of thermal excursion at prototypic flow rates during the ECS addition phase of the LOPA. A FLOPA model was created based on nominal dimensions for the SPRIHTE rig and an assumption that the rig's cylinders were concentrically located. This model can determine when $T_{wall} = T_{sat}$ if adjustments are made to account for differences between measured and calculated subchannel flow and heat transfer rates. To make these adjustments, a multiplier β was applied to the wall saturation temperature criterion ($T_{wall} = \beta\ T_{sat}$, in degrees C) to match measured and calculated powers at which

the saturation temperature was first exceeded at the wall. Based on preliminary test results, a multiplier of 0.878 was recommended for use in calculating LOPA limits for the K-15.1 subcycle. This multiplier provides margins of 14% to 19% between the calculated wall saturation temperature limits and the measured powers at the onset of thermal excursion. The effective margins used in the final LOPA limits, which include dimensional and heat transfer model uncertainties and biases due to eccentricities, range from 38% to 41%. It is estimated that use of the wall saturation temperature criterion lowers the K-14.1 subcycle LOPA core power limit, which is based on a Stanton number of 0.0025, from 41% to 37% of the historical full power of 2400 MW. This report describes the SPRIHTE LOPA tests, describes and evaluates the FLOPA Model for the SPRIHTE tests, discusses selection of a limit criterion for the SPRIHTE tests, and evaluates the transition between high and low flow rate criteria. Calculated results and a sample of FLOPA input for the analysis of the SPRIHTE tests are provided.

24 POWER TRANSMISSION AND DISTRIBUTION

2401 Power Systems

Refer also to citation(s) 32630, 32695

32956 (LUTEDX-TEIE–5074-1-86) **Electric power distribution automation: A potential strategy for the future of power utilities.** Ragnevad, J.; Stellnert, R. Lund Univ. (Sweden). Dept. of Industrial Electrical Engineering and Automation. Dec 1992. 106p. Order Number DE93516736. Source: OSTI; NTIS.

Examination paper.

This report presents the concept of electric power distribution automation (DA). This concept, with its components like distribution SCADA, DSM, and load management, is viewed as a necessity for power companies in a de regulated environment stressing customer orientation and increased efficiency. The need for a corporate strategy for the implementation of DA is emphasized. Various projects are presented and experiences from abroad summarised. Additionally, the Swedish activities and plans within distribution automation are discussed. The report is aimed to be a guide for the future development of DA in Sweden. (77 refs., 15 figs.)

32957 (LUTEDX-TEIE–5077-1-42) **Remote control and load management of electric power distribution networks.** Jonsson, Mats; Larsson, Mikael. Lund Univ. (Sweden). Dept. of Industrial Electrical Engineering and Automation. Feb 1993. 42p. (In Swedish). Order Number DE93516737. Source: OSTI; NTIS.

Examination paper.

Remote control and load management increase the electricity distributors possibilities to even out the consumption of electricity for optimal usage of electricity subscription and supply system. Controlling can be done either through technology or through encouragement of off-peak consumption. There are a number of similar systems for controlling consumption, where the manufacturers have chosen different ways to solve the main problem, namely the communication. We have concentrated in examining systems which communicate through the supply system, different types of telephone connections and wireless communication links. In the future demands for better electricity consumption control will be put forward. This will bring along a greater need at distribution level for continuous monitoring of purchased and used electricity flow. The distributors will also need better possibilities to directly affect power consumption. Those manufacturers who do not use load management today should acquire experience through provincial installations in suitable areas with equipment ready for tomorrows needs and requirements. Today there are some different systems on the market that offer flexibility and ready-to-use possibilities. (3 refs., 17 figs.)

2402 Power System Networks, Transmission and Distribution

32958 (CONF-930102–1) **Design considerations for a fiber optic communications network for power systems.** Kirkham, H. (Jet Propulsion Lab., Pasadena, CA (United States)); Johnston, A.R.; Allen, G.D. Jet Propulsion Lab., Pasadena, CA (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI05-79ET29372. From IEEE Power Engineering Society winter meeting; Columbus, OH (United States); 31 Jan - 4 feb 1993. Order Number DE93018404. Source: OSTI; NTIS; GPO Dep.

The design of a fiber optic communication network for monitoring and control in power systems is discussed. It is shown that by appropriate choice of protocols, a fault-tolerant system can be built that operates in any arbitrary configuration. Since the network is based on fiber optics, it can be made fast enough for substation monitoring and control. In this application, a relatively small number of cables is required to implement a high reliability system. The network can also be used for distribution automation. In this application the network is required to reach all parts of the power system, and the fiber cable itself becomes a significant fraction of the cost of communications. However, since many applications can be supported at once, the cost per function can be reasonable.

32959 **Energy meter.** Chevalier, G.; Bergeron, J.M. 11 Dec 1992. Filed date 10 Jun 1991. Canada patent application 2044193. 48p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

An energy meter is disclosed which determines the rms values of voltage and current across and in each phase of a distribution system as well as arithmetic apparent power, and which also includes means for calibrating the current and voltage rms values. The rms values of voltage and current across and in each phase are obtained by sampling for current and voltage values from each phase. The samples are summed and then correction factors are utilized to provide a more accurate arithmetic apparent power measure. A hardware embodiment is a microcomputer-based system which is programmed to perform demand and energy determinations from rms values of the voltage and current waveforms. The algorithm used in the measurement of energy usage in accordance with the invention is included. 21 figs.

2404 Health and Safety

Refer also to citation(s) 33290

2405 Environmental Aspects

Refer also to citation(s) 33965

32960 (DOE/EA–0702) **Environmental Assessment for Central Power and Light Company's proposed Military Highway-CFE tie 138/69-kV transmission line project Brownsville, Cameron County, Texas.** USDOE, Washington, DC (United States). Apr 1992. 201p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93016914. Source: OSTI; NTIS; GPO Dep.

Central Power and Light Company (CPL) intends to upgrade its existing transmission line ties with the Commision Federal de Electricidad (CFE) system in Mexico. CPL currently has a single 69-kilovolt (kV) transmission line in the Brownsville area which connects CPL's system with the system of CFE. This existing line runs between the Brownsville Switching Station, located on Laredo Road in Brownsville, Cameron County, Texas, and an existing CFE 69-kV line at the Rusteberg Bend of the Rio Grande in Cameron County. Under current conditions of need, the existing 69-kV line does not possess sufficient capability to engage in appropriate power exchanges. Therefore, CPL is proposing to build a new line to link up with CFE. This proposed line would be a double-circuit line, which would (1) continue (on a slightly relocated route) the existing 69-kV tie from CPL's Brownsville Switching Station to CFE's facilities, and (2) add a 138-kV tie from the Military Highway Substation, located on Military Highway (US Highway 281), to CFE's

facilities. The proposed 138/69-kV line, which will be constructed and operated by CPL, will be built primarily on steel single-pole structures within an average 60-foot (ft) wide right-of-way (ROW). It will be approximately 6900–9200 ft (1.3–1.7 miles) in length, depending on the alternative route constructed.

32961 (DOE/EA–0862) **Long-term allocation of power from the Eklutna Project: Environmental Assessment.** USDOE Alaska Power Administration, Juneau, AK (United States). 23 Jun 1993. 9p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93017296. Source: OSTI; NTIS; GPO Dep.

The Alaska Power Administration (APA) has prepared an Environmental Assessment (EA) (DOE/EA-0862) evaluating the Marketing Plan for the Eklutna Project that establishes long-term allocation and sales of power. The proposed long-term sales contract will replace long-term agreements that expire at the end of December, 1993. The EA evaluates the proposed alternative and the no action alternative. The proposed alternative replaces the expiring contracts with new 20-year contracts with the same terms, conditions and allocations as the previous long-term contracts. No other alternatives were developed, as the three preference utilities are the only ones in the marketing area, and the ratio of power allocations with proposed alternative are the same as those contained in a divestiture purchase agreement signed among the power customers. The divestiture of this Federal project is expected to be approved by Congress; the power contracts signed under the marketing plan would remain in force after the sale to the three existing customers, who would then own the project in the same ratio as the power sales contracts. The EA identified no actions associated with the proposal that will cause significant environmental or socioeconomic impacts. The Marketing Plan for the Eklutna Project deals with replacement of expiring contracts.

32962 (DOE/EIS–0162-Summ.) **Final Environmental Impact Statement Resource Programs: Summary.** USDOE Bonneville Power Administration, Portland, OR (United States). Feb 1993. 18p. Sponsored by USDOE, Washington, DC (United States). (DOE/BP–2074). Order Number DE93017386. Source: OSTI; NTIS; INIS; GPO Dep.

BPA's preferred alternative is the Emphasize Conservation Alternative. System and environmental costs are low. Environmental impacts from conservation are minimal. This alternative is cost-effective and environmentally responsible; only the High Conservation Alternative has lower costs and fewer environmental impacts. However, there is some concern about the cost-effectiveness, reliability, and commercial availability of the high conservation resources. If the supply of the additional conservation potential was confirmed and it became cost-effective, the High Conservation Alternative would be preferred. The Draft Resource Programs EIS was released for public review during the summer of 1992. Comments received by letter or in the public hearing held June 16, 1992, were used to revise and update data and analyses of the EIS (public comments and BPA's responses are contained in Volume III of the Final EIS). In addition, a number of revisions were made in the Chapter 3 material describing each resource type, and in Chapter 4 and the Summary, to assure consistency with the modeling and analysis in Chapter 5. Additional information about the capacity aspects of each resource type and alternative has been added, and the material on conservation and its impacts has been reorganized.

2406 Legislation and Regulations

32963 (DOE/EA–0587) **Proposed amendment for Presidential Permit PP-63 and associated modifications to 500 kV international transmission line, Forbes, Minnesota to Manitoba, Canada Northern States Power Company: Final Environmental Assessment.** USDOE, Washington, DC (United States). Feb 1992. 93p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93016881. Source: OSTI; NTIS; GPO Dep.

Northern States Power Company, (NSP), a Minnesota investor owned utility has applied to the Office of Fossil Energy, United States Department of Energy, to amend Presidential Permit PP-63 to allow for alterations to the 500 kV transmission line and as sedated facilities currently regulated by this permit. The alterations proposed for the 500 kV line owned by NSP are part of a long term effort sponsored by NSP to upgrade the existing NSP transmission system to allow for increased exchange of electricity with the Manitoba Hydro-Electric Board. Presidential Permit PP-63 authorized NSP to construct, connect, operate and maintain a 500 kV line at the United States/Canadian border approximately seven-and-a-half miles west of Warroad in Roseau County, Minnesota. This line connects with a 500 kV line owned and operated by the Manitoba Hydro-Electric Board (MHEB), which extends from Dorsey, Manitoba, Canada to the United States/Canadian border. NSP proposes to increase the electricity transfer capability of this transmission facility by constructing a new 80-acre substation on the existing 500 kV line in Roseau County, Minnesota, and upgrading the existing substation at Forbes, Minnesota. The proposed Roseau substation would contain two 41.5 ohm series capacitor banks. In addition, static VAR compensators are to be installed at the existing Forbes Substation. Approximately 5 acres would be added to the 30-acre Forbes site to house the additional equipment. No new lines would enter or exit the facility. NSP proposes to place the new Roseau Substation in service in May 1993 and to complete the upgrading of the Forbes Substation in March 1994. The primary, initial purpose of these modifications is to enable NSP to import 400 megawatts of electric power from MHEB during the summer months to meet peak electrical demand in the Minneapolis-St. Paul area. It is expected that this power transfer would begin in 1993.

25 ENERGY STORAGE

2501 Magnetic

32964 (PNL-SA–22609) **Analysis of superconducting magnetic energy storage applications at a proposed wind farm site near Browning, Montana.** Gaustad, K.L.; De Steese, J.G. Pacific Northwest Lab., Richland, WA (United States). Jul 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-921049–10: Windpower '92, Seattle, WA (United States), 19-23 Oct 1992). Order Number DE93018793. Source: OSTI; NTIS; GPO Dep.

A computer program was developed to analyze the viability of integrating superconducting magnetic energy storage (SMES) with proposed wind farm scenarios at a site near Browning, Montana. The program simulated an hour-by-hour account of the charge/discharge history of a SMES unit for a representative wind-speed year. Effects of power output, storage capacity, and power conditioning capability on SMES performance characteristics were analyzed on a seasonal, diurnal, and hourly basis. The SMES unit was assumed to be charged during periods when power output of the wind resource exceeded its average value. Energy was discharged from the SMES unit into the grid during periods of low wind speed to compensate for below-average output of the wind resource. The option of using SMES to provide power continuity for a wind farm supplemented by combustion turbines was also investigated. Levelizing the annual output of large wind energy systems operating in the Blackfeet area of Montana was found to require a storage capacity too large to be economically viable. However, it appears that intermediate-sized SMES economically levelize the wind energy output on a seasonal basis.

2504 Capacitor Banks

32965 (LA-UR–93-2401) **PIII-61 protection fuse for a 4.5 MJ capacitor bank.** Bartsch, R.R.; Gribble, R.F.; Greene, A.E.; Cochrane, J.C. Los Alamos National Lab., NM (United States). 1993. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930616–20: 9. IEEE pulsed power conference, Albuquerque, NM (United States), 21-23 Jun 1993). Order Number DE93018357. Source: OSTI; NTIS; GPO Dep.

Fusible protection elements have been developed for the 4.5 MJ, Pegasus-II capacitor bank. These fuses are designed to prevent voltage swings of greater than 120% of the maximum capacitor charge voltage – the maximum permitted reversal is the actual charge voltage minus 1.20 times the maximum allowed charge

voltage. This is accomplished without significantly degrading the current wave form except near $T_{1/4} = \pi/2\sqrt{LC}$. A major portion of the capacitor bank stored energy is dissipated in the protection elements, and the voltage during the interruption process is kept as low as possible – unlike for high-performance, opening-switch fusible elements.

2506 Thermal

32966 (LBL–29166) **Seasonal thermal energy storage in unsaturated soils: Model development and field validation.** Doughty, C.; Nir, Aharon, Tsang, Chin-Fu. Lawrence Berkeley Lab., CA (United States). Jun 1991. 81p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93019096. Source: OSTI; NTIS; GPO Dep.

This report summarizes ten years of activity carried out at the Earth Sciences Division of the Lawrence Berkeley Laboratory (LBI) in the subject of seasonal storage of thermal energy in unsaturated soils. The objectives of the work were to make a conceptual study of this type of storage, to offer guidelines for planning and evaluation of the method, to produce models and simulation for an actual field experiment, to participate in an on-line data analysis of experimental results. and to evaluate the results in terms of the validation of the concept, models and the experimental techniques. The actual field experiments were performed in Beer-Sheva, Israel. Details of engineering and field operations are not included in this report.

32967 (LBL–29166-Rev.) **Seasonal thermal energy storage in unsaturated soils: Model development and field validation.** Doughty, C.; Tsang, Chin-Fu. Lawrence Berkeley Lab., CA (United States). Mar 1993. 81p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93019097. Source: OSTI; NTIS; GPO Dep.

This report summarizes ten years of activity carried out at the Earth Sciences Division of the Lawrence Berkeley Laboratory (LBL) in the subject of seasonal storage of thermal energy in unsaturated soils. The objectives of the work were to make a conceptual study of this type of storage, to offer guidelines for planning and evaluation of the method, to produce models and simulation for an actual field experiment, to participate in an on-line data analysis of experimental results. and to evaluate the results in terms of the validation of the concept, models and the experimental techniques. The actual field experiments were performed in Beer-Sheva, Israel. Details of engineering and field operations are not included in this report.

32968 (ORNL/TM–12384) **Thermal energy storage technical progress report, April 1992–March 1993.** Olszewski, M. Oak Ridge National Lab., TN (United States). May 1993. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93018882. Source: OSTI; NTIS; GPO Dep.

The Department of Energy (DOE) is supporting development of thermal energy storage (TES) as a means of efficiently coupling energy supplies to variable heating or cooling demands. Uses of TES include electrical demand-side management in buildings and industry, extending the utilization of renewable energy resources such as solar, and recovery of waste heat from periodic industrial processes. Technical progress to develop TES for specific diurnal and industrial applications under the Oak Ridge National Laboratory's TES program from April 1992 to March 1993 is reported and covers research in the areas of low temperature sorption, thermal energy storage water heater, latent heat storage wallboard and latent/sensible heat regenerator technology development.

32969 (PNL–8717) **Evaluation of diurnal thermal energy storage combined with cogeneration systems: Phase 2.** Somasundaram, S.; Brown, D.R.; Drost, M.K. Pacific Northwest Lab., Richland, WA (United States). Jul 1993. 43p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019106. Source: OSTI; NTIS; GPO Dep.

This report describes the results of a study of thermal energy storage (TES) systems integrated with combined-cycle gas turbine cogeneration systems. Integrating thermal energy storage with conventional cogeneration equipment increases the initial cost of the combined system; but, by decoupling electric power and process heat production, the system offers two significant advantages. First, electric power can be generated on demand, irrespective of the process heat load profile, thus increasing the value of the power produced. Second, although supplementary firing could be used to serve independently varying electric and process heat loads, this approach is inefficient. Integrating TES with cogeneration can serve the two independent loads while firing all fuel in the gas turbine. An earlier study analyzed TES integrated with a simple-cycle cogeneration system. This follow-on study evaluated the cost of power produced by a combined-cycle electric power plant (CC), a combined-cycle cogeneration plant (CC/Cogen), and a combined-cycle cogeneration plant integrated with thermal energy storage (CC/TES/Cogen). Each of these three systems was designed to serve a fixed (24 hr/day) process steam load. The value of producing electricity was set at the levelized cost for a CC plant, while the value of the process steam was for a conventional stand-alone boiler. The results presented here compared the costs for CC/TES/Cogen system with those of the CC and the CC/Cogen plants. They indicate relatively poor economic prospects for integrating TES with a combined-cycle cogeneration power plant for the assumed designs. The major reason is the extremely close approach temperatures at the storage media heaters, which makes the heaters large and therefore expensive.

2509 Batteries

Refer also to citation(s) 32634, 33122, 33286

32970 (DOE/FTR–93014207) **Travel to Germany to attend meeting on lithium batteries: Foreign trip report, May 9–21, 1992.** Levy, S.C. Sandia National Labs., Albuquerque, NM (United States). 15 Jun 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93014207. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The current emphasis on lithium battery research is towards rechargeable systems. There is much work worldwide on carbon materials as intercalation anodes for rechargeable lithium ion batteries, and in the area of polymer electrolytes. Insertion cathodes are also receiving a lot of attention. The level of effort in the areas of metallic lithium anodes and liquid electrolytes has declined.

32971 (LBL–33444) **Energy Conversion and Storage Program: 1992 Annual report.** Cairns, E.J. Lawrence Berkeley Lab., CA (United States). Jun 1993. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93018602. Source: OSTI; NTIS; GPO Dep.

This report is the 1992 annual progress report for the Energy Conversion and Storage Program, a part of the Energy and Environment Division of the Lawrence Berkeley Laboratory. Work described falls into three broad areas: electrochemistry; chemical applications; and materials applications. The Energy Conversion and Storage Program applies principles of chemistry and materials science to solve problems in several areas: (1) production of new synthetic fuels, (2) development of high-performance rechargeable batteries and fuel cells, (3) development of advanced thermochemical processes for energy conversion, (4) characterization of complex chemical processes and chemical species, and (5) study and application of novel materials for energy conversion and transmission. Projects focus on transport-process principles, chemical kinetics, thermodynamics, separation processes, organic and physical chemistry, novel materials, and advanced methods of analysis. Electrochemistry research aims to develop advanced power systems for electric vehicle and stationary energy storage applications. Chemical applications research includes topics such as separations, catalysis, fuels, and chemical analyses. Included in this program area are projects to develop improved, energy-efficient methods for processing product and waste streams from synfuel plants, coal gasifiers, and biomass conversion processes. Materials applications research includes evaluation of the properties of advanced materials, as well as development of novel preparation techniques. For example, techniques such as sputtering, laser ablation, and poised laser deposition are being used to produce high-temperature superconducting films.

32972 (LBL–34386) **Current-potential characteristics of electrochemical systems.** Battaglia, V.S. Lawrence Berkeley Lab., CA (United States). Jul 1993. 210p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93040303. Source: OSTI; NTIS; GPO Dep.

This dissertation contains investigations in three distinct areas. Chapters 1 and 2 provide an analysis of the effects of electromagnetic phenomena during the initial stages of cell discharge. Chapter 1 includes the solution to Maxwell's equations for the penetration of the axial component of an electric field into an infinitely long cylindrical conductor. Chapter 2 contains the analysis of the conductor included in a radial circuit. Chapter 3 provides a complete description of the equations that describe the growth of an oxide film. A finite difference program was written to solve the equations. The system investigated is the iron/iron oxide in a basic, aqueous solution. Chapters 4 and 5 include the experimental attempts for replacing formaldehyde with an innocuous reducing agent for electroless deposition. In chapter 4, current-versus-voltage curves are provided for a sodium thiosulfate bath in the presence of a copper disk electrode. Also provided are the cathodic polarization curves of a copper/EDTA bath in the presence of a copper electrode. Chapter 5 contains the experimental results of work done with sodium hypophosphite as a reducing agent. Mixed-potential-versus-time curves for solutions containing various combinations of copper sulfate, nickel chloride, and hypophosphite in the presence of a palladium disk electrode provide an indication of the reducing power of the solutions.

32973 (SAND–93-1083C) **Environmentally assisted cracking of nickel anode substrates in Li/$SOCl_2$ cells: An engineering approach.** Cieslak, W.R.; Weigand, D.E.; Buchheit, R.G. Sandia National Labs., Albuquerque, NM (United States). [1993]. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-931024–1: 184. meeting of the Electrochemical Society, New Orleans, LA (United States), 10-15 Oct 1993). Order Number DE93015130. Source: OSTI; NTIS; GPO Dep.

Intergranular environmentally assisted cracking (EAC) of Ni anode substrates is likely to occur in a large proportion of Li/$SOCl_2$ cells, but it is not generally detected because in the majority of cases it does not lead to catatrophic failure. However, EAC could become a problem for applications requiring continuous power with high reliability for 10–15 years. In the present work, we determine why simple galvanic couple constant-strain tests do not produce cracking, and introduce a constant strain test that does produce cracking. Objective of this investigation is to determine the stress threshold for cracking as a function of Ni composition and microstructure.

32974 **Non-aqueous secondary lithium battery.** Tobishima, Shinichi; Moriya, Kunio. 29 Dec 1992. Filed date 28 Jun 1991. Canada patent application 2045996. 22p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

An electrolyte is provided for use in a secondary lithium battery comprising vanadium oxide-based cathode active material having a molar ratio of oxygen to vanadium between 2 and 3, an anode active material selected from the group consisting of lithium, lithium ion dischargeable alloys, and lithium ion dischargeable intercalation or insertion compounds, and an electrolyte solution of lithium salt(s) dissolved in a mixed organic solvent. The organic solvent is a mixture of three kinds of solvents, ethylene carbonate (EC), propylene carbonate (PC), and 2-methyltetrahydrofuran (2MeTHF), in the ratio EC(x):PC(y):2MeTHF(z), where x, y, and z are volumetric mixing percentages of each solvent, and $x+y+z=100$, $x<y<z$, and $x+y>50$ (or $z<50$). The resultant secondary lithium battery has a good charge-discharge cycle life and is safe. Results from tests are described to demonstrate the performance of the battery of the invention. 1 fig., 10 tabs.

32975 **Battery monitoring system.** Gibbons, G.P.; Tabler, L.V. 6 Dec 1992. Filed date 5 Jun 1991. Canada patent application 2043959. 26p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

A battery monitoring method and apparatus are provided for monitoring the charge level of a rechargeable electric storage battery. The counter-voltage of the battery is monitored by continuously monitoring the actual terminal voltage of the battery. When the battery is fully charged, the monitor provides a 'do not charge' signal. When the charge level has dropped to a point that there may be some value in recharging the battery, the above signal is replaced with an 'OK to charge' signal. When the battery has discharged to the point where the battery must be recharged in order to avoid damage, the signal is replaced by a 'must charge' signal. Audible signals may accompany the 'OK to charge' and 'must charge' signals. The monitor is self-testing when turned on, and it automatically recognizes the charge level of a battery to which it is connected. When used in association with equipment such as a lift truck, the monitor may include a lift lockout function that is engaged in response to the battery being discharged to the 'must charge' level. 3 figs.

29 ENERGY PLANNING AND POLICY

Refer also to citation(s) 34699

2901 Energy Analysis and Modeling

Refer also to citation(s) 33062, 33109

32976 (DOE/EIA–0293(93)) **Directory of Energy Information Administration Models 1993.** USDOE Energy Information Administration, Washington, DC (United States). Office of Statistical Standards. 6 Jul 1993. 137p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93016987. Source: OSTI; NTIS; GPO; GPO Dep.

This directory contains descriptions about each model, including the title, acronym, purpose, followed by more detailed information on characteristics, uses, and requirements. Sources for additional information are identified. Included in this directory are 35 EIA models active as of May 1, 1993. Models that run on personal computers are identified by "PC" as part of the acronym. EIA is developing new models, a National Energy Modeling System (NEMS), and is making changes to existing models to include new technologies, environmental issues, conservation, and renewables, as well as extend forecast horizon. Other parts of the Department are involved in this modeling effort. A fully operational model is planned which will integrate completed segments of NEMS for its first official application–preparation of EIA's Annual Energy Outlook 1994. Abstracts for the new models will be included in next year's version of this directory.

32977 (DOE/FTR–93017247) **Travel to Poland to provide support to clean coal and energy efficiency projects: Foreign trip report, March 21–April 9, 1992.** Secrest, T.J. Pacific Northwest Lab., Richland, WA (United States). 8 May 1992. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93017247. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The trip consisted of four activities, the purposes of which were: Krakow Clean Fossil Fuel and Energy Efficiency Project. To further define the activities within the scope of Subproject 1 of the US AID/DOE Krakow Clean Fossil Fuel and Energy Efficiency Project to reduce the level of pollution caused by low emission sources. The primary focus was on defining the demonstration of efficiency measures in a class of apartment buildings and defining an assessment for extending the district heating system. Krakow Polish-American Children's Hospital Energy Efficiency Assessment. To conduct an assessment of the hospital's thermal energy supply and using systems to identify low cost actions for reducing energy consumption and the operating and maintenance costs of its energy systems. This assessment will serve as the basis for developing recommendations for a subsequent, detailed, development of specific applicable measures/actions for improving the energy efficiency of the hospital's energy systems. Integrated Resource Planning Support to Poland. To provide support to FEWE, the Polish energy efficiency center, for the development of capability in the area of integrated resource planning for utility energy services.

Integrated Resource Planning Support to Czechoslovakia. To provide support to SEVEn, the Czechoslovakian energy efficiency center, for the development of capability in the area of integrated resource planning for utility energy services.

32978 (ECN-C–93-029) **Task Force on Integrated Energy and Environmental Planning: The Netherlands - Poland: Volume 4: Verification and extension of the Polish energy and environmental data base.** Van Arkel, W. (Unit ECN Policy Studies, Netherlands Energy Research Foundation, Petten (Netherlands)); Grajwoda, Z.; Klimont, Z.; Nowakowski, J. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Jul 1993. 145p. Order Number DE93524592. Source: OSTI; NTIS; Available from the library of the Netherlands Energy Research Foundation (ECN), P.O. Box 1, 1755 ZG Petten (Netherlands).

The methodology and results of the studies performed by the title Task Force are described in a series of publications carrying the same title. The series consists of four volumes. Three Working Papers are related to Volume 2.

The current study concerns a comparison between Polish and Dutch data on energy technologies associated with the energy models SELPE, ENPEP and DORSEK-E. In addition, the data base of the Polish Ministry of Industry and Trade was used as a reference for the current situation in Poland. The aim of this comparison was to verify the contents of the Polish data bases, and to extend the Polish data bases with energy technologies which will become available in the near future and with abatement technologies to reduce the SO2 and NOx emissions. It turned out that many differences exist between the data bases. In a number of cases these differences can be explained by a different use of the data by the energy models, but in other cases data were adjusted according to the most recent information. The data base comparison also considered how the energy sector is mathematically described by the models, and a number of recommendations are made. In addition to energy and environmental data, special attention was paid to the technologies within the refinery sector. 6 figs., 8 tabs., 3 appendices

32979 (ECN-C–93-030) **Task Force on Integrated Energy and Environmental Planning: The Netherlands - Poland: Volume 2: Integrated economy-energy-environment policy in Poland: A computable general equilibrium modelling approach.** Hille, E. (Polish Foundation of Energy Efficiency, Warsaw (Poland)); Szukalski, S.; Van Leeuwen, M.J.; Velthuijsen, J.W.; Van der Linden, N.H.; Pellekaan, W.; Niemyski, M.; Umer, A. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Jul 1993. 107p. (SEO–301). Order Number DE93524593. Source: OSTI; NTIS; Available from the library of the Netherlands Energy Research Foundation (ECN), P.O. Box 1, 1755 ZG Petten (Netherlands).

The methodology and results of the studies performed by the title Task Force are described in a series of publications carrying the same title. The series consists of four volumes. Three Working Papers are related to Volume 2.

The current study examines the interactions between the energy sector, the rest of the economy and the environment in Poland. This is done by means of a Computable General Equilibrium (CGE) model, in which three energy sectors are distinguished and special attention is paid to the consequences of environmental policy. Due to the ongoing political and economic reforms in Poland important components of energy demand, such as the economic structure, energy efficiency and life style, will undergo major changes in the coming decades, and, consequently, will affect the future demand for energy. Because reliable energy demand scenarios are of utmost importance to the formulation of energy policy, it was decided to develop a CGE model to be able to analyze the interactions between the economy, the energy sector and the environment in Poland. The CGE model was employed to construct four alternative scenarios for the development of the Polish economy up to the year 2015: (1) the base-case scenario reflects the situation when no new policy measures will be implemented during the planning horizon; (2) the oil price scenario examines the impacts on the Polish economy of an considerable increase of the world market oil price; (3) the environmental tax scenario analyses the impact of a tax imposed on coal and fuel and (4) the environmental limit scenario shows how upper limits on the levels of emissions affect the economy. The scenario results show that the base and bulk goods industries in Poland have only limited growth potential and are very sensitive to changes in the world market price for oil. Another striking result is that the long term environmental objectives of the Polish government regarding the reduction of SO_2 and NO_2 can be achieved without severe consequences for the economic development. 13 figs., 14 tabs., 5 appendices, 21 refs.

32980 (ECN-RX–93-071) **Experiences with the application of different energy models in East European countries.** Van Oostvoorn, F.; Van den Broek, M.; Van Harmelen, T.; Van der Linden, N.; Pellekaan, W. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Jul 1993. 25p. Order Number DE93524587. Source: OSTI; NTIS; Available from the library of the Netherlands Energy Research Foundation (ECN), P.O. Box 1, 1755 ZG Petten (Netherlands).

Paper presented at the International Workshop on Environmental Management in a Transition to Market Economy: A Challenge to Government and Business, Geneva, January 6-9, 1993.

Former centrally planned East European countries are faced with many constraints and uncertainties in transforming their economies into more efficient and less polluting market economies. Particularly managing the very complex process of changes in their economy within a few years, while similar changes in the Western societies took many decades, poses an extreme challenge to the policy decision makers at ministries and firms in East European countries. Many questions can be raised concerning our ability to cope with these restructuring processes. Are the tools and analytical approaches presently used in Western countries to support energy/environmental decisions also applicable in East European economies? Can they really cope with the specific issues and questions raised during the period of transformation? The past two years researchers of the Netherlands Energy Research Foundation in Petten, Netherlands, have been involved in several energy/environment policy studies in Poland, Hungary and recently Czech and Slovak republics. Among the applied methodologies were: CHP (combined generation of heat and power) investment appraisal by IRR and Payback time; least-cost planning; and integrated energy/economy/environment modelling. A brief overview of the conducted studies and experiences gained by the studies is presented. Finally attention will be paid to the limitations and applicability of the different analytical approaches for policy decisions support in the East European countries. 1 fig., 1 tab., 5 refs.

32981 (NEI-DK–1261) **Coherent plan of resources for a small-town community.** Viborgegnens Energi- og Miljoekontor, Viborg (Denmark). Jun 1992. 120p. (In Danish). Order Number DE93525256. Source: OSTI; NTIS.

It is suggested that in relation to local energy and environmental planning it is necessary to coordinate with relevant technological development. Plans should be flexible. The project, which concerns planning management, is concentrated on a small-town community in Jutland, Denmark, where it is easier to restrict the consumption of resources and to recirculate the resources used. The social, environmental and economic consequences are calculated with regard to four models concerning a 25% saving on energy by decreasing the use of electricity, heating and water by 25%, reducing the collection services for wastes and cleaning waste water locally, by the instigation of a 50% cutdown of current energy use during the next 30 years resulting in a 54.65 reduction of carbon dioxide emission, and the initiation of straw-based district-heating supply and cogeneration based on biogas. The consequences of these initiatives will also be local income increase from sale of straw as local fuel source, an increase in local employment, a reduction of expenses connected to purchase of heating supply etc. and disposal of wastes, and free total renovation of individual households' heating systems. This involves a coordinated plan for the community and its local resources as a whole. The planning method, and all that it implies, is described in detail. (AB) (18 refs.)

32982 (PNL-SA–22611) **Energy life-cycle analysis modeling and decision support tool.** Hoza, M.; White, M.E. Pacific Northwest Lab., Richland, WA (United States). Jun 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE

Contract AC06-76RL01830. (CONF-9306213–1: Latin American Energy Conference, La Jolla, CA (United States), 6-8 Jun 1993). Order Number DE93017669. Source: OSTI; NTIS; GPO Dep.

As one of DOE's five multi-program national laboratories, Pacific Northwest Laboratory (PNL) develops and deploys technology for national missions in energy and the environment. The Energy Information Systems Group, within the Laboratory's Computer Sciences Department, focuses on the development of the computational and data communications infrastructure and automated tools for the Transmission and Distribution energy sector and for advanced process engineering applications. The energy industry is being forced to operate in new ways and under new constraints. It is in a reactive mode, reacting to policies and politics, and to economics and environmental pressures. The transmission and distribution sectors are being forced to find new ways to maximize the use of their existing infrastructure, increase energy efficiency, and minimize environmental impacts, while continuing to meet the demands of an ever increasing population. The creation of a sustainable energy future will be a challenge for both the soft and hard sciences. It will require that we as creators of our future be bold in the way we think about our energy future and aggressive in its development. The development of tools to help bring about a sustainable future will not be simple either. The development of ELCAM, for example, represents a stretch for the computational sciences as well as for each of the domain sciences such as economics, which will have to be team members.

2902 Economics and Sociology

Refer also to citation(s) 32247, 32981, 33004, 33010, 33011, 33018, 33040, 33043, 33119, 33735

32983 (ANL/ESD/TM–48) **The federal energy policy: An example of its potential impact on energy consumption and expenditures in minority and poor households.** Poyer, D.A. Argonne National Lab., IL (United States). Sep 1991. 67p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93018492. Source: OSTI; NTIS; GPO Dep.

This report presents an analysis of the relative impacts of the National Energy Strategy on majority and minority households and on nonpoor and poor households. (Minority households are defined as those headed by black or Hispanic persons; poor households are defined as those having combined household income less than or equal to 125% of the Office of Management and Budget's poverty-income threshold.) Energy consumption and expenditures, and projected energy expenditures as a share of income, for the period 1987 to 2009 are reported. Projected consumptions of electricity and nonelectric energy over this period are also reported for each group. An analysis of how these projected values are affected under different housing growth scenarios is performed. The analysis in this report presents a preliminary set of projections generated under a set of simplifying assumptions. Future analysis will rigorously assess the sensitivity of the projected values to various changes in a number of these assumptions.

32984 (ETDE-IT–93-214) **Internationalisation process of OECD countries: Sectoral analysis.** Perrucci, A. (ENEA, Rome (Italy). Direzione Studi). May 1992. 34p. (In Italian). Quaderni Studi 1. Order Number DE93522983. Source: OSTI; NTIS (US Sales Only).

An analysis, based on statistical information from the Institute for Research and Information on Multinationals, is made of the sectoral distribution of foreign direct investment in the USA, Japan, Germany, France, Italy and the United Kingdom. An attempt is also made to establish a relationship between data on foreign trade and direct investment. The sectors examined include: food and beverages, chemical, textiles and clothing, machinery and other manufactured goods. This trend analysis of international trade and capital flow interactions is essentially explorative in nature and has the scope of investigating empirical evidence and providing purely indicative results.

32985 (ETDE-IT–93-215) **Technology development risk assessment and mixed interests.** Borrelli, G. (ENEA, Rome (Italy). Direzione Studi); Sartori, S. May 1992. 126p. (In Italian). Quaderni Studi 2. Order Number DE93522984. Source: OSTI; NTIS (US Sales Only); INIS.

The main purpose of this work is to demonstrate by means of a critical analysis of the state-of-the-art in technological and environmental risk analysis and decision making, that risk and environmental management decisions involve heterogeneous groups of social actors, each representing conflicting interests. It is argued that risk analyses should therefore be based on social interaction and communication paradigma, as well as, on a new rational way of thinking concerning the optimum choice of suitable technological development strategies leading towards a publicly acceptable balance between national energy-economic strategic necessities and social and individual perception of risk.

32986 (LA-SUB–93-245) **Pilot Project on Women and Science: A report on women scientists at the University of New Mexico and Los Alamos National Laboratory.** Salvaggio, R. (New Mexico Univ., Albuquerque, NM (United States)). Los Alamos National Lab., NM (United States); New Mexico Univ., Albuquerque, NM (United States). 1993. 182p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93019305. Source: OSTI; NTIS; GPO Dep.

In the fall of 1991, through the coordinating efforts of the University of New Mexico and Los Alamos National Laboratory, the Pilot Project on Women and Science was initiated as a year-long study of women scientists at both the university and the laboratory. Its purpose was to gather information directly from women scientists in an attempt to analyze and make recommendations concerning the professional and cultural environment for women in the sciences. This report is an initial attempt to understand the ways in which women scientists view themselves, their profession, and the scientific culture they inhabit. By recording what these women say about their backgrounds and educational experiences, their current positions, the difficult negotiations many have made between their personal and professional lives, and their relative positions inside and outside the scientific community, the report calls attention both to the individual perspectives offered by these women and to the common concerns they share.

32987 (LBL-PUB–727) **Community Relations Plan for Lawrence Berkeley Laboratory: Environmental Restoration Program.** Lawrence Berkeley Lab., CA (United States); ICF Kaiser Engineers, Inc., Oakland, CA (United States). Jul 1993. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93018596. Source: OSTI; NTIS; GPO Dep.

The Lawrence Berkeley Laboratory (LBL) has applied to the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC), for renewal of its Hazardous Waste Handling Facility Permit. A permit is required under Resource Conservation and Recovery Act (RCRA) regulations. The permit will allow LBL to continue using its current hazardous waste handling facility, upgrade the existing facility, and construct a replacement facility. The new facility is scheduled for completion in 1995. The existing facility will be closed under RCRA guidelines by 1996. As part of the permitting process, LBL is required to investigate areas of soil and groundwater contamination at its main site in the Berkeley Hills. The investigations are being conducted by LBL's Environmental Restoration Program and are overseen by a number of regulatory agencies. The regulatory agencies working with LBL include the California Environmental Protection Agency's Department of Toxic Substances Control, the California Regional Water Quality Control Board, the Bay Area Air Quality Management District, the East Bay Municipal Utilities District, and the Berkeley Department of Environmental Health. RCRA requires that the public be informed of LBL's investigations and site cleanup, and that opportunities be available for the public to participate in making decisions about how LBL will address contamination issues. LBL has prepared this Community Relations Plan (CRP) to describe activities that LBL will use to keep the community informed of environmental restoration progress and to provide for an open dialogue with the public on issues of importance. The CRP documents the community's current concerns about LBL's Environmental Restoration Program. Interviews conducted between February and April

1993 with elected officials, agency staff, environmental organizations, businesses, site neighbors, and LBL employees form the basis for the information contained in this document.

32988 (LIU-TEMA-T-R–31) **Water power and environmental protection: An analysis of the public opinion against water power development in Sweden 1950-1990.** Anshelm, J. Linkoeping Univ. (Sweden). Dept. of Technology and Social Change. 1992. 124p. (In Swedish). (LIU-TEMA-V-R–18). Order Number DE93516739. Source: OSTI; NTIS; INIS.

This study illuminates the first large environmental debate after World War 2: the struggle against the harnessing of the northern Swedish rivers. The fascinating question is raised of how it was possible for an unparliamentary environmental protection movement to make itself heard, and influence the Swedish energy policy, though their arguments were contrary to the outspoken interests of the industry, the trade unions, and the social democratic government. This was the more fascinating because the values the opinion stressed wore of ethic, esthetic, biological, and conservation economical nature.

32989 (NEI-DK–1267-Ed.2) **Energy and the protection of nature: An environmental-geographical contribution to the Nordic action plan for nature protection.** Roskilde Universitetscenter. Institut for geografi, samfundsanalyse og datalogi. Forskningsrapport, 89. Czeskleba-Dupont, R.; Markussen, P. Roskilde Universitescenter (Denmark). Inst. for Geografi, Samfundsanalyse og Datalogi. 1993. 120p. (In Danish). Order Number DE93525249. Source: OSTI; NTIS.

Historical as well as contemporary energy options are described for each of the Nordic countries and related to their environmental impacts and alternative, less detrimental modes of action. Scandinavian low-energy scenarios show that the accomplishment of ambitious and just environmental standards presupposes a tighter integration of contiguous energy systems. This may be accomplished either by increased electricity or natural gas transports between countries. The interplay between ecological and economical systems is analyzed from the point of view of alternative production technologies. Rational use of energy may be combined with a transition from fossil and nuclear to renewable, non-nuclear energy sources, and gain economic competitiveness. This should not be made dependen upon the maintenance of low energy prices at the given international level, as done in Sweden. Recommendations to achieve sustainable energy development in the sense of the U.N. Brundtland-report can be realized, if supply side domination in the energy sectors is reduced. Instead, regional development should be strengthened by integrating energy networks, especially by extensive use of local cogeneration of heat and electricity. With reference to the German Oeko-Institut, eco-potentials for EEC-countries, including Denmark, are delineated. It is recommended to make analogous assessments for other Nordic countries. Denmark and Finland may (akin to France and Belgium) need special international assistance in the energy transitions. This should be further worked out in regional scenarios both within and between countries. The EEC commission's electricity scenarios from 1990 are of no help in this respect, being of the one-dimensional high-energy type. Studies for the Nordic Council of Ministers have, however, substantiated the alternative view and must be incorporated in responsible energy planning. (au)

32990 (NEI-NO–347) **Efficient contracts in a game of nations pursuing greenhouse gas emissions abatement.** Torvanger, A. Oslo Univ. (Norway). Sosialoekonomisk Inst. Mar 1993. 39p. Order Number DE93516701. Source: OSTI; NTIS.

A group of nations contract to limit greenhouse gas emissions. They are facing incentive problems in terms of moral hazard since individual emission abatement efforts cannot be observed by other nations. The report discuss contracts that correct the incentive problem by specifying a liability to an international policing institution if some chosen emission abatement target is not met. A nation with a low risk aversion and high marginal effort disutility must face a relatively high liability. All deviations by one or more nations are prevented if each nation's liability is high enough to discourage a unilateral deviation. The necessary liability is lower for a non-budget-balancing contract as compared to a budget-balancing contract. In a repeated game of risk-neutral nations where observation of total efforts is uncertain, a trigger mechanism can be constructed to induce nations to exert the higher cooperative effort level. If the chosen target is not met, a fixed-length non-cooperative punishment period is triggered. Cooperative periods will be intervened by punishment periods of fixed length. The nation that gains most from a unilateral deviation to a lower effort level and has the highest expected benefit in a non-cooperative period sets the lower bound on the punishment period length and the upper bound on the emission abatement target. 15 refs., 1 fig., 2 tabs.

32991 (NEI-NO–348) **The design of a carbon tax in an incomplete international climate agreement.** Golombek, R. (Centre for Research in Economics and Business Administration (SNF), Oslo (Norway)); Hagem, C.; Hoel, M. Oslo Univ. (Norway). Sosialoekonomisk Inst. Jan 1993. 52p. Order Number DE93516702. Source: OSTI; NTIS.

In a situation where all countries participate in an agreement to reduce CO_2 emissions, taxes on consumption and production of fossil fuels have identical economic consequences, and cost efficiency suggests that a carbon tax should be equalized across all types of fossil fuels per unit of carbon. This is no longer true in an incomplete agreement, where a group of countries seeks to maximize its welfare, subject to a constraint on carbon emission from all countries. It is shown that when the cooperating countries use a tax on consumption of fossil fuels as the only policy instrument, the tax per unit of carbon should in general be differentiated across fossil fuels. When both production and consumption of internationally traded fossil fuels are taxed, there exists a particular combination of producer and consumer taxes which is optimal. It is also shown that with this tax, the sum of the consumer tax and producer tax should be equal across all fossil fuels per unit of carbon. We close the paper by giving an empirical illustration of the theoretical analysis, assuming the cooperating countries consist of the OECD countries. 36 refs., 4 tabs.

32992 (SAND–93-0700) **Annual report: Purchasing and Materials Management Organization, Sandia National Laboratories, fiscal year 1992.** Zaeh, R.A. Sandia National Labs., Albuquerque, NM (United States). Apr 1993. 151p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018442. Source: OSTI; NTIS; GPO Dep.

This report summarizes the purchasing and transportation activities of the Purchasing and Materials Management Organization for Fiscal Year 1992. Activities for both the New Mexico and California locations are included. Topics covered in this report include highlights for fiscal year 1992, personnel, procurements (small business procurements, disadvantaged business procurements, woman-owned business procurements, New Mexico commercial business procurements, Bay area commercial business procurements), commitments by states and foreign countries, and transportation activities. Also listed are the twenty-five commercial contractors receiving the largest dollar commitments, commercial contractors receiving commitments of $1,000 or more, integrated contractor and federal agency commitments of $1,000 or more from Sandia National Laboratories/New Mexico and California, and transportation commitments of $1,000 or more from Sandia National Laboratories/New Mexico and California.

32993 (UCRL-ID–114503) **Impact of the proposed energy tax on nuclear electric generating technologies.** Edmunds, T.A.; Lamont, A.D.; Pasternak, A.D.; Rousseau, W.F.; Walter, C.E. Lawrence Livermore National Lab., CA (United States). May 1993. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93018909. Source: OSTI; NTIS; GPO Dep.

The President's new economic initiatives include an energy tax that will affect the costs of power from most electric generating technologies. The tax on nuclear power could be applied in a number of different ways at several different points in the fuel cycle. These different approaches could have different effects on the generation costs and benefits of advanced reactors. The Office of Nuclear Energy has developed models for assessing the costs and benefits of advanced reactor cycles which must be updated to take into account the impacts of the proposed tax. This report has been

prepared to assess the spectrum of impacts of the energy tax on nuclear power and can be used in updating the Office's economic models. This study was conducted in the following steps. First, the most authoritative statement of the proposed tax available at this time was obtained. Then the impacts of the proposed tax on the costs of nuclear and fossil fueled generation were compared. Finally several other possible approaches to taxing nuclear energy were evaluated. The cost impact on several advanced nuclear technologies and a current light water technology were computed. Finally, the rationale for the energy tax as applied to various electric generating methods was examined.

2903 Environment, Health, and Safety

Refer also to citation(s) 32401, 32429, 32430, 32495, 32560, 32978, 32981, 33023, 33024, 33043, 33044, 33750, 33753, 33786, 33798, 33962, 34702

32994 (BNL–49158) **Guidelines for accident prevention and emergency preparedness.** Fthenakis, V.M.; Morris, S.C.; Moskowitz, P.D. Brookhaven National Lab., Upton, NY (United States). May 1993. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE93018383. Source: OSTI; NTIS; GPO Dep.

This report reviews recent developments in the guidelines on chemical accident prevention, risk assessment, and management of chemical emergencies, principally in the United States and Europe, and discusses aspects of their application to developing countries. Such guidelines are either in the form of laws or regulations promulgated by governments, or of recommendations from international, professional, or non governmental organizations. In many cases, these guidelines specify lists of materials of concern and methods for evaluating safe usage of these materials and recommend areas of responsibility for different organizations; procedures to be included in planning, evaluation, and response; and appropriate levels of training for different classes of workers. Guidelines frequently address the right of communities to be informed of potential hazards and address ways for them to participate in planning and decision making.

32995 (DOE/EH–0326) **Protocols for conducting Environmental Management Assessments of DOE organizations.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Office of Environmental Audit. [1993]. 60p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93017966. Source: OSTI; NTIS; GPO Dep.

To assess the effectiveness of DOE's environmental programs, the Office of Environmental Audit conducts Environmental Management Assessments of DOE programs and facilities. These assessments take a broad programmatic view of environmental systems which may cover multiple sites. The focus of the assessment is on the infrastructure, systems, programs, and tools to manage environmental issues, not on the compliance issues themselves. Protocols have been developed to assist in the conduct of Environmental Management Assessments. The protocols are, based on and serve as implementing guidelines for the Environmental Management Section of "Performance Objectives and Criteria for Conducting DOE Environmental Audits" (DOE/EH-022). They are intended to provide guidance to the Assessment Team in conducting these reviews.

32996 (DOE/FTR–93012690) **International symposium and exhibition of experimental technologies: Foreign trip report, May 29–June 6, 1992.** Stokes, R.A.; Overend, R.P. National Renewable Energy Lab., Golden, CO (United States). 22 Sep 1992. 61p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE93012690. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The Earth Summit was to be the follow through by the United Nations (UN) on the recommendations of the World Commission on Environment and Development that was chaired by Gro Harlem Brundtland. The Brundtland committee as it became known, published a seminal book in 1987 titled Our Common Future, which was its final report to the UN. This book captured popular and political sentiment by coining the term Sustainable Development - a loose concept that embodies the notion that there could be forms of progress that would meet the present day needs of society without compromising the ability of future generations to meets theirs. Though difficult to define in practice; everybody intuitively understands that the goal of sustainable development if to address the growing problems of poverty and environmental degradation in the world. As a result the Earth Summit embodied a series of very contentious issues that included all of the North - South agenda of the last decade; an agenda that is polarized by the wealth disparity between the industrialized countries of the "North" and the Less Developed Countries (LDC) of the "South."

32997 (DOE/NV–353) **US Department of Energy DOE Nevada Operations Office, Nevada Test Site: Underground safety and health standards.** USDOE Nevada Operations Office, Las Vegas, NV (United States). May 1993. 139p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93018393. Source: OSTI; NTIS; INIS; GPO Dep.

The Nevada Test Site Underground Safety and Health Standards Working Group was formed at the direction of John D. Stewart, Director, Nevada Test Site Office in April, 1990. The objective of the Working Group was to compile a safety and health standard from the California Tunnel Safety Orders and OSHA for the underground operations at the NTS, (excluding Yucca Mountain). These standards are called the NTS U/G Safety and Health Standards. The Working Group submits these standards as a RECOMMENDATION to the Director, NTSO. Although the Working Group considers these standards to be the most integrated and comprehensive standards that could be developed for NTS Underground Operations, the intent is not to supersede or replace any relevant DOE orders. Rather the intent is to collate the multiple safety and health references contained in DOE Order 5480.4 that have applicability to NTS Underground Operations into a single safety and heath standard to be used in the underground operations at the NTS. Each portion of the standard was included only after careful consideration by the Working Group and is judged to be both effective and appropriate. The specific methods and rationale used by the Working Group are outlined as follows: The letter from DOE/HQ, dated September 28, 1990 cited OSHA and the CTSO as the safety and health codes applicable to underground operations at the NTS. These mandated codes were each originally developed to be comprehensive, i.e., all underground operations of a particular type (e.g., tunnels in the case of the CTSO) were intended to be adequately regulated by the appropriate code. However, this is not true; the Working Group found extensive and confusing overlap in the codes in numerous areas. Other subjects and activities were addressed by the various codes in cursory fashion or not at all.

32998 (DTH-IVBT–71) **Urban traffic environment: Local surveying of environmental effects.** Vaeroe, H. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Inst. for Veje, Trafik og Byplan. 1993. 280p. (In Danish). Order Number DE93525250. Source: OSTI; NTIS.

The term traffic environment covers noise, air pollution, vibrations and aesthetical considerations effected by the continuous presence of traffic and also the general feeling of traffic induced insecurity. The main victims, the author suggests, are urban dwellers who are pedestrians, cyclists and people whose homes are located alongside roads bearing heavy traffic. Local municipalities mainly concentrate on preventing breakdowns in traffic flow, although they do make efforts to reduce road accidents. Nuisances such as the severance effect (feeling cut off from other parts of town by daunting roads carrying heavy traffic loads), traffic induced insecurity and visual intrusion are difficult to evaluate. Computerized calculations based on traffic intensity, driving speeds, street dimensions, uncertainty and ugliness must be carried out. Nuisances must be correctly defined and variations in density, noise etc. accurately reckoned. Following this, the impacts of these nuisances must be calculated, not only concentrating on the number of people affected but also on how annoying these nuisances are. A total sum of annoyance must be found. Weighting various traffic plans is a vital planning process. Some of the described methods were tested in an actual urban area in Hilleroed, Denmark. The main conclusion

is that a thorough environmental survey is possible even though resources are limited. It is demonstrated that the subject of traffic environment encompasses technical, statistical, ethical, aesthetic, political philosophical and decision-making aspects and gives detailed information on how to tackle urban traffic planning problems. (AB) (132 refs.)

32999 (ECN-C–93-021) **CO_2 abatement in the Netherlands: A study following UNEP guidelines.** Ybema, J.R.; Okken, P.A.; Kram, T.; Lako, P. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Jul 1993. 78p. Project ECN 7121. Order Number DE93524591. Source: OSTI; NTIS; Available from the library of the Netherlands Energy Research Foundation (ECN), P.O. Box 1, 1755 ZG Petten (Netherlands).

CO_2 emission reduction scenarios have been made for the Netherlands' energy system for various CO_2 reduction targets and for the years 2010 and 2030. The study is one of the country studies which closely follows the guidelines assessed by UNEP. UNEP has developed these guidelines to allow for the performance of national greenhouse gas abatement costing studies on a common basis. For the Netherlands' study the MARKAL model, a linear optimization model tool-box, has been used to configure cost-optimal CO_2 abatement strategies. Using a mixture of different CO_2 limiting technologies, is the most effective way to achieve emission reduction. The results indicate that drastic emission reductions, 37.5% in 2010 and 75% in 2030 relative to baseline emissions, can technically be attained when the option of CO_2 removal is allowed. Costs for CO_2 abatement increase exponentially with increasing reduction targets. Remarks have been made about the macro-economic effects and implementation problems of the reduction strategies. The use of the UNEP guidelines has been evaluated and recommendations have been made to improve them. 21 figs., 18 tabs., 1 appendix, 27 refs.

33000 (NEI-NO–360) **Evaluation of the RAIN project: Reversing acidification in Norway.** Stuanes, A.; Dickson, W.; Jenkins, A.; Rasmussen, L.; Stordal, F. Norges Allmennvitenskapelige Forskningraad, Oslo (Norway). Nov 1991. 21p. Order Number DE93525293. Source: OSTI; NTIS; INIS.

This report presents a scientific assessment of the RAIN project. It describes the main hypotheses tested and the applied methods. The major results of the research are highlighted and discussed, and they are placed in the perspective of national and international acid rain research. An important part of the RAIN project has been to provide information to the public about the acid rain problem, and in this way it has performed an important background role in influencing political decisions and legislation. The RAIN project is regarded as a cost effective research effort, and the novel approach and capital investment will enable further manipulation studies at these sites in the future. It is recommended that the project is continued in the immediate future, with some modification to answer specific questions resulting from the collected data. 24 refs., 6 figs., 1 tab.

33001 (ORNL/M–1899) **Safe Drinking Water Act: Environmental Guidance Program Reference Book: Revision 6.** Oak Ridge National Lab., TN (United States). 15 Sep 1992. 515p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93041181. Source: OSTI; NTIS; GPO Dep.

This report presents information on the Safe Drinking Water Act. Sections are presented on: Legislative history and statute; implementing regulations; and updates.

33002 (PNL–8770) **An external peer review of the U.S. Department of Energy's assessment of "damages and benefits of the fuel cycles: Estimation methods, impacts, and values": Final report.** Pacific Northwest Lab., Richland, WA (United States). 9 Aug 1993. 77p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019184. Source: OSTI; NTIS; INIS; GPO Dep.

The need for better assessments of the "external" benefits and costs of environmental effects of various fuel cycles was identified during the development of the National Energy Strategy. The growing importance of this issue was emphasized by US Department of Energy (DOE) management because over half of the states were already pursuing some form of social costing in electricity regulation and a well-established technical basis for such decisions was lacking. This issue was identified as a major area of controversy–both scientifically and politically–in developing energy policies at the state and national level. In 1989, the DOE's Office of Domestic and International Energy Policy commissioned a study of the external environmental damages and benefits of the major fuel cycles involved in electric power generation. Over the next 3-year period, Oak Ridge National Laboratory and Resources for the Future conducted the study and produced a series of documents (fuel cycle documents) evaluating the costs of environmental damages of the coal, oil, natural gas, biomass, hydroelectric, and nuclear fuel cycles, as well as the Background Document on methodological issues. These documents described work that took almost 3 years and $2.5 million to complete and whose implications could be far reaching. In 1992, the Secretary of Energy sought advice on the overall concepts underlying the studies and the means employed to estimate environmental externalities. He asked the Secretary of Energy's Advisory Board to undertake a peer review of the fuel cycle studies and encouraged the Board to turn to outside expertise, as needed.

33003 (RFP–4729) **Rebaselining seismic risks for resumption of Building 707 plutonium operations at the Rocky Flats Plant.** Elia, F. Jr. (Stone and Webster Engineering Corp., Boston, MA (United States)); Foppe, T.; Stahlnecker, E. EG and G Rocky Flats, Inc., Golden, CO (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC34-90RF62349. (CONF-9310102–2: 4. energy natural phenomena hazards mitigation conference, Atlanta, GA (United States), 19-22 Oct 1993). Order Number DE93018801. Source: OSTI; NTIS; GPO Dep.

Natural phenomena risks have been assessed for plutonium handling facilities at the Rocky Flats Plant, based on numerous studies performed for the Department of Energy Natural Phenomena Hazards Project. The risk assessment was originally utilized in the facilities Final Safety Analysis Reports and in subsequent risk management decisions. Plutonium production operations were curtailed in 1989 in order for a new operating contractor to implement safety improvements. Since natural phenomena events dominated risks to the public, a re-assessment of these events were undertaken for resumption of plutonium operations.

2904 Energy Resources

Refer also to citation(s) 33753

33004 (DOE/FTR–93014872) **Travel to Europe for program to maintain communications with regional renewable-resource industries: Foreign trip report, January 20–February 7, 1992.** White, G.W. Westinghouse Hanford Co., Richland, WA (United States). 2 Mar 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93014872. Source: OSTI; NTIS (US Sales Only); GPO Dep.

We visited both Western and formerly Eastern Bloc countries. We met with a cross-section of people in those countries representing government, church, business, and renewable-resource industries. Because changes happen almost daily, there is a feeling of uncertainty, fear and uneasiness among resident populations, but almost everyone we met with feels that there is hope, and that this new-found democracy will work. Environmental damage was evident in most of the areas we visited. At the same time, there is a lot of "cleaning up" being done. There is a strong sense of duty to recycling programs. Having been subsidized by the state for a long time, many people are finding it tough learning to make ends meet on their own. There are signs of a developing, free-market economy everywhere in the major cities we visited. This is a new experience for many would-be store owners. Some of the early success stories center around those that deal in the black market. Black marketeers seem to be natural entrepreneurs and to make money in a free-market economy. There are many opportunities for western nations to invest in Europe, especially in the former Eastern Bloc countries. Many have done just that, spending large sums to re-tool and make factories productive and profitable. There are risks where laws don't already exist to protect investors.

In many places energy sources are being run to capacity. There is a sentiment of "no more nukes" in places like Germany. But in Czechoslovakia and other former Eastern Bloc nations, there is dependence on nuclear energy. Throughout the tour there did not appear to be any shortage of consumer products or food supplies but infrastructure, especially in transportation systems, was lacking. Until these emerging countries are able to adapt more liberal import/export programs transport of durable and perishable goods will continue to be an impedance to improving relations and economies.

2905 Research, Development, Demonstration, and Commercialization

Refer also to citation(s) 32243, 32262, 32263, 32433, 32584, 33021, 33026, 33041, 33106, 33112, 33119, 33141, 33151, 33192, 33235, 33286

33005 (DOE/EIA–0149(92)) **EIA publications directory, 1992.** National Energy Information Center, Washington, DC (United States). 24 Jun 1993. 58p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93016833. Source: OSTI; NTIS; INIS; GPO; GPO Dep.

This directory contains abstracts and ordering information for EIA publications. The abstracts are arranged by broad subject category such as coal, petroleum, natural gas, and electric power. A comprehensive subject index, a title index, and a report number index are included. Each entry gives the title, report number, publication frequency, date, number of pages, and ordering information. Publication began with the 1979 edition.

33006 (DOE/ER–0535P/2) **DOE New Technology, Sharing New Frontiers: April 1992–March 1993.** Tamura, A.; Henline, D.M. (eds.). USDOE Office of Scientific and Technical Information, Oak Ridge, TN (United States). May 1993. 103p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93012401. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Purpose of this publication is to provide information on how to access specific technologies developed through research sponsored by DOE. It describes technologies identified as having potential for commercial applications, in addition to a catalog of current patent applications and patents available for licensing from DOE and DOE contractors. 368 items are included in this issue.

33007 (DOE/ER/75667–1) **Nevada's energy research strategy: Progress report, September 30, 1991–September 29, 1992.** McNelis, D.N. Nevada Univ., Las Vegas, NV (United States). Oct 1992. 155p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER75667. Order Number DE93019883. Source: OSTI; NTIS; GPO Dep.

This document was produced by the University and Community College System of Nevada (UCCSN) under a grant from the US Department of Energy (DOE) Office of Energy Research as part of the DOE-Experimental Program for the Simulation of Competitive Research (DOE-EPSCoR). The document develops Nevada's strategies for the UCCSN to broaden and deepen energy-related research over the next five years in hydrology sciences, environmental biology and chemistry, chemical physics, and global change. A strategy was also developed to support energy-related research with education and human resources in science, math and engineering. A key concept of these strategies is continued success under the DOE-EPSCOR program. Participation in the Environmental Restoration and Waste Management, Civilian Radioactive Waste Management, Basic Energy Science and Global Climate Change programs in collaboration with the Nevada Test Site and DOE multi-program laboratories is also part of Nevada's strategy for success in energy-related research.

33008 (DOE/FTR–93014673) **Travel to Russia for discussions on potential on non-weapon nuclear collaborations: Foreign trip report, May 26–June 2, 1992.** Hunter, T.O. Sandia National Labs., Albuquerque, NM (United States). 22 Jun 1992. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93014673. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report details travel to Russia to discuss with representatives of MIN ATOM and the two Russian weapons institutes, Arzamas-16 and Chelyabinsk-70, broad areas of potential non weapon collaboration with the three US weapons laboratories.

33009 (ECN-C–93-032) **Task Force on Integrated Energy and Environmental Planning: The Netherlands - Poland: Working Paper 1: Description of the former and current energy administration of Poland.** Bojarski, W. (Dept. of Energy Problems, Polish Institute of Fundamental Technological Research, Warsaw (Poland)); Filipczak, W.F. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Jul 1993. 34p. Order Number DE93524595. Source: OSTI; NTIS; Available from the library of the Netherlands Energy Research Foundation (ECN), P.O. Box 1, 1755 ZG Petten (Netherlands).

The methodology and results of the studies performed by the title Task Force are described in a series of publications carrying the same title. The series consists of four volumes. Three Working Papers are related to Volume 2.

This study deals with the former and current Energy Administration in Poland and gives a detailed description of the tasks and responsibilities and the hierarchical relationships between the main executive bodies. In addition, the place and role of energy planning within this framework is explained. Since the start of the reforms in 1990 the Energy Administration has been subjected to significant structural changes and this restructuring process is not yet complete. Therefore, the current structure of the energy related administration in Poland should be regarded as temporary because further changes are required which will be implemented in the near future in order to arrive at a new organizational structure meeting the demands of the new political and economical order in Poland. 6 figs.

33010 (ETDE-IT–93-216) **Choice of technology development policy: Reflections based on national innovative systems analysis.** Perrucci, A. (ENEA, Rome (Italy). Direzione Studi). 1992. 76p. (In Italian). Quaderni Studi 10. Order Number DE93522985. Source: OSTI; NTIS (US Sales Only).

In attempting to shed some light on the desired characteristics of suitable national technology development strategies in a newly emerging global socio-economic environment called technonationalism, this paper evaluates and compares the technological capacity and competitiveness of the USA, Japan and the major European countries. The analysis is based on a comparison of the structural make-ups of the different national research and development and industrial frameworks. Wherever possible, reference is made tothe influence of institutional factors. The R&D investment component of overall high-tech product sales, per capita patents issued, global share of patents and high-tech exports are taken into account in the assessment of technological capacity in terms of both size and performance.

33011 (ETDE-IT–93-217) **Production, R&D activities and costs in Italian high-tech industries.** Carbone, F. (ENEA, Rome (Italy). Direzione Studi). 1993. 58p. (In Italian). Quaderni Studi 15. Order Number DE93522986. Source: OSTI; NTIS (US Sales Only).

With the aim of establishing the essential characteristics of suitable government strategies directed towards the effective development of Italian high-technology industries, this paper performs an in-depth analysis of the structural differences among key high-tech sectors in relation to the socio- economic aspects qualifying the processes technological innovation. The distinctive characteristics of the leading industries operating within the high-technology sectors are identified through assessments of major indicators such as production, R&D expenditure and organizational structure. The analysis evidences the clear tendency of processes of technological development to take on always more specific characteristics.

33012 (ORNL/ATD–75) **Lightweight materials for transportation: Program plan.** Oak Ridge National Lab., TN (United States). [1993]. 107p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93017381. Source: OSTI; NTIS; GPO Dep.

This Program Plan has been prepared by the Office of Transportation Materials in response to a request by the House

Committee on Appropriations. It recognizes that a significant commitment to long-term, stable materials research and development (R&D) is required to realize the benefits of lighter weight vehicles, including economic, environmental and energy related benefits. Extensive input was obtained from the major US automakers and from representative materials and component suppliers. Considerable interaction with the key members of the US Automotive Materials Partnership (USAMP) has ensured consistency of technical direction. The program will support R&D activity at industrial sites through competitively bid subcontracts with cost sharing anticipated at 30–50%, with the higher amounts in process scale-up and manufacturing technology development. The recommended LWM Program will enable industry to develop pecessary technology by utilizing their capabilities as well as accessing supporting technology at national laboratories, universities, ongoing program activity at NASA, DoD, DOT, NIST, etc., and thereby leverage industry resources through integrated team approaches. Many individual program efforts are currently in place that address small portions of the overall needs of the LWM Program, both within DOE and in other agencies. Cognizance of these and overall integration of research activities are planned as significant program management tasks. Because of the international nature of the automobile business, benchmarking of foreign technology and tracking of worldwide developments are also key program elements.

33013 (ORNL/FTR–4586) **Travel to Mexico to assist in the planning and development of R&D Magazine: Foreign trip report, April 29–May 3, 1993.** Trivelpiece, A.W. Oak Ridge National Lab., TN (United States). 16 May 1993. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93015466. Source: OSTI; NTIS (US Sales Only); GPO Dep.

I requested information from the Department of Energy national laboratory directors and several deans of academic institutions. The responses are enclosed as part of this report. At the meeting, I participated in discussions of these and other story lines. Experience from last year indicates of those ideas I recommended, more than 80 percent became stories in R&D Magazine. The agenda indicates the subject areas covered and those in attendance. Participation in this meeting is of great value to DOE in terms of assisting the editors of R&D Magazine in defining the areas of future emphasis of story lines.

33014 (SAND–92-2395) **Sandia technology engineering and science accomplishments.** Sandia National Labs., Albuquerque, NM (United States). Mar 1993. 71p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93017676. Source: OSTI; NTIS; GPO; GPO Dep.

Sandia is a DOE multiprogram engineering and science laboratory with major facilities at Albuquerque, New Mexico, and Livermore, California, and a test range near Tonapah, Nevada. We have major research and development responsibilities for nuclear weapons, arms control, energy, the environment, economic competitiveness, and other areas of importance to the needs of the nation. Our principal mission is to support national defense policies by ensuring that the nuclear weapon stockpile meets the highest standards of safety, reliability, security, use control, and military performance. Selected unclassified technical activities and accomplishments are reported here. Topics include advanced manufacturing technologies, intelligent machines, computational simulation, sensors and instrumentation, information management, energy and environment, and weapons technology.

33015 (SAND–93-0183C) **New applications for high average power beams.** Neau, E.L.; Turman, B.N.; Patterson, E.L. Sandia National Labs., Albuquerque, NM (United States). 1993. 4p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930616–21: 9. IEEE pulsed power conference, Albuquerque, NM (United States), 21-23 Jun 1993). Order Number DE93018845. Source: OSTI; NTIS; INIS; GPO Dep.

The technology base formed by the development of high peak power simulators, laser drivers, FEL's, and ICF drivers from the early 60's through the late 80's is being extended to high average power short-pulse machines with the capabilities of supporting new types of manufacturing processes and performing new roles in environmental cleanup applications. This paper discusses a process for identifying and developing possible commercial applications, specifically those requiring very high average power levels of hundreds of kilowatts to perhaps megawatts. The authors discuss specific technology requirements and give examples of application development efforts. The application development work is directed at areas that can possibly benefit from the high specific energies attainable with short pulse machines.

33016 (UCRL–53689-92) **Laboratory Directed Research and Development FY 1992.** Struble, G.L.; Middleton, C.; Anderson, S.E.; Baldwin, G.; Cherniak, J.C.; Corey, C.W.; Kirvel, R.D.; McElroy, L.A. (eds.). Lawrence Livermore National Lab., CA (United States). [1992]. 246p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93018392. Source: OSTI; NTIS; INIS; GPO Dep.

The Laboratory Directed Research and Development (LDRD) Program at Lawrence Livermore National Laboratory (LLNL) funds projects that nurture and enrich the core competencies of the Laboratory. The scientific and technical output from the FY 1992 RD Program has been significant. Highlights include (1) Creating the first laser guide star to be coupled with adaptive optics, thus permitting ground-based telescopes to obtain the same resolution as smaller space-based instruments but with more light-gathering power. (2) Significantly improving the limit on the mass of the electron antineutrino so that neutrinos now become a useful tool in diagnosing supernovas and we disproved the existence of a 17-keV neutrino. (3) Developing a new class of organic aerogels that have robust mechanical properties and that have significantly lower thermal conductivity than inorganic aerogels. (4) Developing a new heavy-ion accelerator concept, which may enable us to design heavy-ion experimental systems and use a heavy-ion driver for inertial fusion. (5) Designing and demonstrating a high-power, diode-pumped, solid-state laser concept that will allow us to pursue a variety of research projects, including laser material processing. (6) Demonstrating that high-performance semiconductor arrays can be fabricated more efficiently, which will make this technology available to a broad range of applications such as inertial confinement fusion for civilian power. (7) Developing a new type of fiber channel switch and new fiber channel standards for use in local- and wide-area networks, which will allow scientists and engineers to transfer data at gigabit rates. (8) Developing the nation's only numerical model for high-technology air filtration systems. Filter designs that use this model will provide safer and cleaner environments in work areas where contamination with particulate hazardous materials is possible.

33017 (UCRL–53868-92) **Engineering Research and Development and Technology thrust area report FY92.** Langland, R.T.; Minichino, C. (eds.). Lawrence Livermore National Lab., CA (United States). Mar 1993. 252p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93016334. Source: OSTI; NTIS; INIS; GPO Dep.

The mission of the Engineering Research, Development, and Technology Program at Lawrence Livermore National Laboratory (LLNL) is to develop the technical staff and the technology needed to support current and future LLNL programs. To accomplish this mission, the Engineering Research, Development, and Technology Program has two important goals: (1) to identify key technologies and (2) to conduct high-quality work to enhance our capabilities in these key technologies. To help focus our efforts, we identify technology thrust areas and select technical leaders for each area. The thrust areas are integrated engineering activities and, rather than being based on individual disciplines, they are staffed by personnel from Electronics Engineering, Mechanical Engineering, and other LLNL organizations, as appropriate. The thrust area leaders are expected to establish strong links to LLNL program leaders and to industry; to use outside and inside experts to review the quality and direction of the work; to use university contacts to supplement and complement their efforts; and to be certain that we are not duplicating the work of others. This annual report, organized by thrust area, describes activities conducted within the Program for the fiscal year 1992. Its intent is to provide timely summaries of objectives, theories, methods, and results. The nine thrust areas for this fiscal year

are: Computational Electronics and Electromagnetics; Computational Mechanics; Diagnostics and Microelectronics; Emerging Technologies; Fabrication Technology; Materials Science and Engineering; Microwave and Pulsed Power; Nondestructive Evaluation; and Remote Sensing and Imaging, and Signal Engineering.

2906 Nuclear Energy

Refer also to citation(s) 32364, 32584, 32789, 32790, 32791, 32792, 32793, 32795, 32910, 32976, 33035, 33130, 33735

33018 (ETDE-IT–93-218) **Evolution of French nuclear power plants, their availability and fuel management.** Massini, G. (ENEA, Rome (Italy). Direzione Studi). 1993. 105p. (In Italian). Quaderni Studi 16. Order Number DE93522987. Source: OSTI; NTIS (US Sales Only).

The French nuclear power program, with the broadness of its scope and determination with which it has been carried out, is unique in many aspects. In light of the fact that Italian energy policy makers are now reconsidering the still in effect national moratorium on nuclear power, and to provide some insight as to the possible benefits of the re-vitalization of the Italian nuclear power industry, this paper has a look at the history of the successful development of the French nuclear power industry. It evidences the factors which have shaped and limited this development and assesses the positive and negative aspects of the overall results. First, a survey is made of the current composition of France's national nuclear power park and its evolution with time; then, the salient aspects of the decisions which have strongly influenced the development of France's vital industry are identified. The paper concludes with a survey of the French nuclear power industry's safety and reliability record and with an estimate of the amount of spent fuel produced and reprocessed.

33019 (INIS-mf–13682) **Review on the role of nuclear power.** Cao Chi (Institute of Nuclear Science and Technology, Hanoi (Viet Nam)); Le Van Hong; Nguyen Tri Ho. Viet Nam National Atomic Energy Commission, Ha Noi (Viet Nam). Mar 1993. 53p. (In Vietnamese). Sponsored by National Centre of Scientific and Technical Information and Documents, Ha Noi (Viet Nam). Const 1992/TTTL. Order Number DE94600317. Source: OSTI; NTIS (US Sales Only); INIS.

This report consists of 2 parts. The first part reviews opinions against nuclear power on the aspects: waste disposal, safety and environment, financial; technology, etc. and gives results of a preliminary survey for nuclear power in Vietnam among scientists in 1990. The second part presents advanced reactor concepts and advantages of nuclear power to economy and environment in comparison with other energy sources. (N.H.A). 39 refs, 9 figs, 2 tabs.

33020 (NUREG–0750-Vol.37-No.5) **Nuclear Regulatory Commission Issuances, May 1993: Volume 37, No. 5.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Freedom of Information and Publications Services. May 1993. 69p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). Source: OSTI; NTIS; INIS; GPO.

This report contains the issuances received during the specified period (May 1993) from the Commission (CLI), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judges (ALJ), the Directors' Decisions (DD), and the Denials of Petitions for Rulemaking (DPRM). The summaries and headnotes preceding the opinions reported herein are not deemed a part of these opinions or have any independent legal significance. Contents of this document include an Issuance of the Nuclear Regulatory Commission with respect to the Sacramento Municipal Utility District and Issuances of Directors' Decisions concerning the Interstate Nuclear Service Corporation; Niagara Mohawk Power Corporation; and Texas Utilities Electric Company, et al. and All Nuclear Power Plants with Thermo-Lag Fire Barriers.

2908 Heat Utilization

Refer also to citation(s) 33108

33021 (NEI-DK–1257) **Decentral cogeneration of electric power and heat in Denmark.** Energistyrelsen, Copenhagen (Denmark); Ramboell, Hannemann og Hoejlund A/S, Copenhagen (Denmark). Jun 1993. 33p. (In Danish). Order Number DE93516673. Source: OSTI; NTIS.

A note on the status of development of cogeneration plants in Denmark produced by the Danish Energy Agency for persons involved in this branch. The Danish government's energy and environmental political aims are also explained for the sake of experts in other countries who are interested in Danish know-how in the field of cogeneration. Technological, operational and economical aspects of cogeneration are described and illustrated with two actual examples. Possibilities for further development of mini and industrial cogeneration plants are briefly elaborated. A list of existing Danish decentral cogeneration plants is presented with information on fuels utilized, type of plant, production, calorific values and date of establishment. Information on research activities and policy is also given. The text is richly illustrated with relevant data. (AB)

2910 Conservation

Refer also to citation(s) 33027, 33044, 33080

33022 (LBL–32941) **Advanced monitoring technologies for the evaluation of demand-side management programs.** De Almeida, A.T. (Coimbra Univ. (Portugal). Dept. of Electrical Engineering); Vine, E.L. Lawrence Berkeley Lab., CA (United States); California Inst. for Energy Efficiency, Berkeley, CA (United States). Jun 1993. 50p. Sponsored by California Inst. for Energy Efficiency, Berkeley, CA (United States). DOE Contract AC03-76SF00098. Order Number DE93019098. Source: OSTI; NTIS; GPO Dep.

This report was commissioned by the California Institute for Energy Efficiency as part of its research mission to advance the energy efficiency and productivity of all end-use sectors in California. The aim of this study is to provide an assessment of the state-of-the-art technologies that can be used for monitoring and evaluating demand-side management (DSM) programs. Additionally, the study points out research, development, and demonstration projects whose implementation can contribute to a more accurate and cost-effective evaluation of the performance of end-use technologies. During the past two decades, technology developments in the fields of microelectronics, computers and communications had a large impact on monitoring equipment. The improvements achieved led to the appearance of increasingly powerful, convenient to use, and flexible equipment, enabling a wider application of end-use metering at a lower cost. Equipment specifications are getting closer and closer to an "ideal" monitoring system: Good accuracy, high reliability, moderate cost, large number of monitored end uses, large data storage capacity, flexible communications, non-intrusiveness, powerful preprocessing of data. This report briefly examines the following techniques that can be used for end-use monitoring: field test equipment, general purpose data loggers, run-time data loggers, utility-oriented data loggers, energy management systems, two-way communication, power line carrier techniques, direct and distributed load control, and non-intrusive load monitoring. The report concludes with recommendations for developing new measurement technologies, as well as additional research and development activities to support these efforts.

33023 (NEI-DK–1242) **Energy development up to the year 2005: Introduction to the conference of June 14th-15th, 1993, on the follow up of Energy 2000.** Energistyrelsen, Copenhagen (Denmark). Jun 1993. 102p. (In Danish). Order Number DE93516646. Source: OSTI; NTIS.

The report aims to give a more detailed description of the development within the field of energy up to the year 2000 based on the initiatives which it has already been decided to carry out. It gives a picture of how this development would be if further activities were not to be carried out in order to limit the use of energy and reduce the emission of carbon dioxide. The energy and environmental consequences of various development possibilities regarding energy supply and carbon dioxide reduction that would follow a reconstruction of energy supply are elaborated. The general conclusion is that developments up to the year 2005 will result in a higher energy consumption than was expected when the publication "Energy

2000" was produced by the Danish Ministry of Energy - if further initiatives are not carried out. This publication pointed out in which ways Denmark could contribute to the development of a sustainable energy policy ensuring a reduction of energy consumption which would work towards the abatement of environmental pollution, and it was based on the well known "Brundtland Report". The level of fuel consumption can be kept stable if even more decentral and industrial cogeneration plants are constructed. A satisfactory reduction of carbon dioxide emission, if no further energy saving initiatives are carried out, will demand a significant reconstruction of energy production strategy if energy production alone is to be held responsible for the reduction of carbon dioxide emission. (AB)

33024 (NEI-DK–1243) **Catalogue of ideas: Introduction to the conference of June 13th-14th, 1993, on the follow up of "Energy 2000".** Energistyrelsen, Copenhagen (Denmark). Jun 1993. 100p. (In Danish). Order Number DE93516738. Source: OSTI; NTIS.

The aim of this catalogue of ideas related to the Danish conference of June 13th-14th, 1993 (on the follow up of "Energy 2000", the government paper on energy and environmental policy based on the well known "Brundtland Report") was to present a number of suggestions for initiatives that could work towards the goals of "Energy 2000" related to the reduction of carbon dioxide emission and of energy consumption by the year 2005. Denmark has already used a large amount of resources in order to achieve a significant reduction of energy and the Danish public has felt and understood the consequences of this policy. But more initiatives are needed in order to maintain sustainable energy and environmental policies. (AB)

33025 (ORNL/CON–326) **National impacts of the Weatherization Assistance Program in single-family and small multifamily dwellings.** Brown, M.A.; Berry, L.G.; Balzer, R.A.; Faby, E. Oak Ridge National Lab., TN (United States). May 1993. 398p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93018884. Source: OSTI; NTIS; GPO Dep.

Since 1976, the US Department of Energy (DOE) has operated one of the largest energy conservation programs in the nation – the low-income Weatherization Assistance Program. The program strives to increase the energy efficiency of dwellings occupied by low-income persons in order to reduce their energy consumption, lower their fuel bills, increase the comfort of their homes, and safeguard their health. It targets vulnerable groups including the elderly, people with disabilities, and families with children. The most recent national evaluation of the impacts of the Program was completed in 1984 based on energy consumption data for households weatherized in 1981. DOE Program regulations and operations have changed substantially since then: new funding sources, management principles, diagnostic procedures, and weatherization technologies have been incorporated. Many of these new features have been studied in isolation or at a local level; however, no recent evaluation has assessed their combined, nationwide impacts to date or their potential for the future. In 1990, DOE initiated such an evaluation. This evaluation is comprised of three "impact" studies (the Single-Family Study, High-Density Multifamily Study, and Fuel-Oil Study) and two "policy" studies. Altogether, these five studies will provide a comprehensive national assessment of the Weatherization Assistance Program as it existed in the 1989 Program Year (PY 1989). This report presents the results of the first phase of the Single-Family Study. It evaluates the energy savings and cost effectiveness of the Program as it has been applied to the largest portion of its client base – low-income households that occupy single-family dwellings, mobile homes, and small (2- to 4-unit) multifamily dwellings. It is based upon a representative national sample that covers the full range of conditions under which the program was implemented in PY 1989.

33026 (ORNL/CON–368) **Energy Efficiency and Renewable Energy Program: Bibliography, 1993 edition.** Vaughan, K.H. Oak Ridge National Lab., TN (United States). Jun 1993. 151p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93017936. Source: OSTI; NTIS; GPO Dep.

The Bibliography contains listings of publicly available reports, journal articles, and published conference papers sponsored by the DOE Office of Energy Efficiency and Renewable Energy and published between 1987 and mid-1993. The topics of Bibliography include: analysis and evaluation; building equipment research; building thermal envelope systems and materials; district heating; residential and commercial conservation program; weatherization assistance program; existing buildings research program; ceramic technology project; alternative fuels and propulsion technology; microemulsion fuels; industrial chemical heat pumps; materials for advanced industrial heat exchangers; advanced industrial materials; tribology; energy-related inventions program; electric energy systems; superconducting technology program for electric energy systems; thermal energy storage; biofuels feedstock development; biotechnology; continuous chromatography in multicomponent separations; sensors for electrolytic cells; hydropower environmental mitigation; environmental control technology; continuous fiber ceramic composite technology.

2920 Supply, Demand, and Forecasting

Refer also to citation(s) 32976, 33005, 33040, 33063, 33064, 33065, 33072

33027 (LBL–33441) **Energy Analysis Program: 1992 Annual report.** Lawrence Berkeley Lab., CA (United States). Jun 1993. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93018527. Source: OSTI; NTIS; GPO Dep.

The Program became deeply involved in establishing 4 Washington, D.C., project office diving the last few months of fiscal year 1942. This project office, which reports to the Energy & Environment Division, will receive the majority of its support from the Energy Analysis Program. We anticipate having two staff scientists and support personnel in offices within a few blocks of DOE. Our expectation is that this office will carry out a series of projects that are better managed closer to DOE. We also anticipate that our representation in Washington will improve and we hope to expand the Program, its activities, and impact, in police-relevant analyses. In spite of the growth that we have achieved, the Program continues to emphasize (1) energy efficiency of buildings, (2) appliance energy efficiency standards, (3) energy demand forecasting, (4) utility policy studies, especially integrated resource planning issues, and (5) international energy studies, with considerate emphasis on developing countries and economies in transition. These continuing interests are reflected in the articles that appear in this report.

33028 (NEDO-P–9231) **Field survey of information collected Pacific energy policies.: Rural electrification and photovoltaic generation in Sarawak.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1993. 235p. (In Japanese). Sponsored by New Energy and Industrial Technology Development Organization, Tokyo (Japan). Order Number DE93520884. Source: OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan.

For the purpose of examining information on petroleum substitution energy, a field survey is made on regional electrification and dispersed power sources of the photovoltaic power generation, etc. in Sarawak, Malaysia. At present, in the State of Sarawak, an electrification rate of 56% is achieved. The Sarawak Electricity Supply Corporation (SESCO) has been mainly promoting the regional electrification, mostly extension of the transmission system. With regard to the photovoltaic power generation facilities in the State of Sarawak, there are two kinds of facilities: one is facilities for electric utility business (2 places, 18kW and 17kW) installed by assistance of Belgian government and owned and managed by SESCO, and the other is small scale facilities for private power generation (more than 35 places, mostly 1kW of less) installed by the Sarawak state government through sales activities of non-government companies. Both kinds are independent on-site power sources without interconnecting with other power sources. The government seems to consider that for reasons of high cost, the photovoltaic power generation should be introduced not for regional electrification but for electrification of remote areas. 58 figs., 48 tabs.

33029 (NEDO-P–9253) **Report of analytical survey of Pacific energy information.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1993. 340p. (In Japanese). Sponsored by New Energy and Industrial Technology Development Organization, Tokyo (Japan). Order Number DE93520886. Source: OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan.

A survey and data collection are made in countries in the Pacific-rim region to arrange an information exchange system useful for stabilization of energy supply and demand in the region. In the second collection of information, 14 countries excluding Indonesia sent back floppy disks with energy supply/demand data. The countries excluding three perfectly filled out their formats for physical quantity, thermal conversion factor, and thermal quantity. Time series data, which are mostly retroactive to 1980, are obtained by the countries excluding two. Five countries gave no data for the first quarter of 1992. As to the inventory situation, data are very ununiform. An energy balance table is made based on the data from each country, but there are some inadequacies such as imperfect grasp of final consumption and inconformity of input/output. In view of the results of this survey, improvements are made on unification of the standards for thermal conversion factor aiming at conformity with other statistics, new installation of an inventory transformation sector, deletion of non-commercial energy, unification of primary power conversion factors, etc.

2930 Policy, Legislation, and Regulation

Refer also to citation(s) 32616, 32996, 33020, 33071, 33072, 33073, 33074, 33075, 33076, 33729, 33798

33030 (ECN-C–93-031) **Task Force on Integrated Energy and Environmental Planning: The Netherlands - Poland: Working Paper 2: Government institutions of the energy sector in the EC countries.** Kant, A.D. (Unit ECN Policy Studies, Netherlands Energy Research Foundation, Petten (Netherlands)); Verhagen, H.M. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Jul 1993. 65p. Order Number DE93524594. Source: OSTI; NTIS; Available from the library of the Netherlands Energy Research Foundation (ECN), P.O. Box 1, 1755 ZG Petten (Netherlands).

The methodology and results of the studies performed by the title Task Force are described in a series of publications carrying the same title. The series consists of four volumes. Three Working Papers are related to Volume 2.

The Polish Government is interested in a broad perspective of institutional arrangements in the national energy sector. A brief review of energy administrations in the EC countries illustrates that only a few of the energy ministries established in 1970's after the oil crisis still remain. At present, energy departments are incorporated in a ministry of economic affairs or trade and industry and have broad energy policy responsibilities. Their subdivisions are oriented towards energy resources and in some cases also with energy conservation. Energy is not treated as a common commodity, but is strongly controlled by legislation. Germany and United Kingdom have the most strongly privatized energy sectors in EC but nevertheless still have a plethora of laws concerning pricing, investment, organization, monopolies, supply areas, grid development, maintenance, etc. Government involvement in energy sector is still far greater than set by EC policies directed to privatisation and competition. Comparison of energy administrations of Poland and EC countries is hampered by incomparable key economic figures and different political and cultural traditions; however the overall institutional set-up for energy has some common characteristics in the EC countries: Energy departments within a ministry of economic affairs are subdivided according to energy carriers and include energy conservation and energy planning units in general energy policy units. Polish parliament is responsible for election and establishment of an adequate and competent energy administration structure. Energy planning plays an important role in EC countries. National energy plans are strongly related to key economic figures for economic sectors and subsectors and are usually commissioned by general policy units in the department of energy and updated at regular intervals. They function as anchor points for industry, thus providing basic data.

33031 (LBL-PUB–729) **Guidelines for metrication at Lawrence Berkeley Laboratory.** Lawrence Berkeley Lab., CA (United States). Jul 1993. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93018531. Source: OSTI; NTIS; GPO Dep.

This document provides a set of guidelines for the metric transition process already under way at Lawrence Berkeley Laboratory. LBL has embarked upon this course in response to Section 5164 of the Trade and Competitiveness Act of 1988, Executive Order 12770 of 1991, and DOE Order 5900.2. The core provision of DOE Order 5900.2 is Section 7b, which states: "Metric usage shall be required except to the extent that such use is impractical, or is likely to cause significant inefficiencies to, or loss of markets by United States firms, or an inability of the Department to fulfill its responsibilities under the laws of the Federal Government and the United States." LBL's metrication policy is meant to comply with this requirement by aggressively fostering metrication. The purpose of these guidelines is to optimize the coherence and the cost-effectiveness of the metrication process.

33032 (NEI-DK–1270) **Energy 2000: Status for meeting the requirements.** Energiministeriet, Copenhagen (Denmark). Apr 1993. 32p. (In Danish). Order Number DE93525262. Source: OSTI; NTIS.

The aim of the leaflet published by the Danish Ministry of Energy was to assess to what extent the demands set by the government plan of management Energy 2000 based on the well-known Brundtland Report have currently been met. Recently, a new Danish government has come into power, and the current Minister of Energy briefly states the government's views on the subject. Included are also summaries of sections of the plan of management and plans for future development. It is explained that stricter measures must be taken to reduce carbon dioxide emission involving a closer coordination of efforts. Information is given on the status of measures taken under the headings of energy conservation, making electricity and heating supply more efficient, the use of cleaner energy sources, tariffs, taxation and subsidization, research, development and promotion of commercial production and international cooperation within the field of energy. Cogeneration plants using less pollutive fuel must substitute district heating plants. The wind power industry should be further developed and the use of natural gas increased. About 30 district heating plants now using coal or oil will soon use straw or wood fuels. Government committees will discuss further the uses of tariffs, taxes and subsidies aimed at reducing carbon dioxide emission. Energy research will also be further discussed in depth, and a closer connection with the needs and prospects of the Danish industrial sector is wished for, with emphasis on exports. The concept of sustainability demands a broader definition of economical growth. (AB)

33033 (ORNL/M–483) **Environmental Guidance Program Reference Book: American Indian Religious Freedom Act.** Oak Ridge National Lab., TN (United States). Nov 1987. 106p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93041213. Source: OSTI; NTIS; GPO Dep.

This Reference Book contains a copy of the American Indian Religious Freedom Act and guidance for DOE compliance with the statute. The document is provided to DOE and contractor staff for informational purposes only and should not be interpreted as legal guidance. Updates that include important new requirements will be provided periodically.

33034 (ORNL/M–1178) **National Historic Preservation Act and Related Legislation: Environmental Guidance Program reference book.** Oak Ridge National Lab., TN (United States). 1 May 1990. 258p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93041180. Source: OSTI; NTIS; GPO Dep.

This document contains information regarding the National Historic Preservation Act and related legislation. The act was designed to protect archaeological and historic resources.

33035 (ORNL/M–1900) **Atomic Energy Act and Related Legislation. Environmental Guidance Program Reference Book: Revision 6.** Oak Ridge National Lab., TN (United States). 1 Sep 1992. 567p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93008331. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents information related to the Atomic Energy Act and related legislation. Sections are presented pertaining to legislative history and statutes, implementing regulations, and updates.

2940 Fossil Fuels

Refer also to citation(s) 32301, 32321, 32976, 33005

33036 (DOE/EIA–0035(93/07)) **Monthly energy review, July 1993.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 27 Jul 1993. 170p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93018112. Source: OSTI; NTIS; GPO; GPO Dep.

This publication presents information and compiled data on energy sources. The following information is presented: energy overview; energy consumption; petroleum; natural gas; oil and gas resource development; coal; electricity; nuclear energy; energy prices; and international energy.

33037 (DOE/EIA–0380(93/06)) **Petroleum marketing monthly, June 1993.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 10 Jun 1993. 174p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93017681. Source: OSTI; NTIS; GPO; GPO Dep.

This publication is designed to give information and statistical data about a variety of crude oils and refined petroleum products. The publication provides statistics on crude oil costs and refined petroleum products sales for use by industry, government, private sector analysts, educational institutions, and consumers. Data on crude oil include the domestic first purchase price, the f.o.b. and landed cost of imported crude oil, and the refiners' acquisition cost of crude oil. Sales data for motor gasoline, distillates, residuals, aviation fuels, kerosene, and propane are presented.

33038 (DOE/EIA–0487(92)) **Petroleum marketing annual, 1992.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. Jul 1993. 420p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93018813. Source: OSTI; NTIS; GPO Dep.

This publication contains statistical data on a variety of crude oils and refined petroleum products. The publication provides statistics on crude oil costs and refined petroleum products sales for use by industry, government, private sector analysts, educational institutions, and consumers. Data on crude oil include the domestic first purchase price, the free-on-board (f.o.b.) and landed cost of imported crude oil, and the refiners' acquisition cost of crude oil. Sales data for motor gasoline, distillates, residuals, aviation fuels, kerosene, and propane are presented.

33039 (DOE/EIA–0543(93/1Q)) **US energy industry financial developments, 1993 first quarter.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 25 Jun 1993. 18p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93017108. Source: OSTI; NTIS; GPO; GPO Dep.

Net income for 259 energy companies– including, 20 major US petroleum companies– rose 38 percent between the first quarter of 1992 and the first quarter of 1993. An increased level of economic activity, along with colder weather, helped lift the demand for natural gas. crude oil, coal, and electricity. The sharp rise in the domestic price of natural gas at the wellhead relative to the year-ago quarter was the most significant development in US energy during the first quarter. As a consequence of higher natural gas prices, the upstream segment of the petroleum industry reported large gains in income, while downstream income rose due to higher refined product demand. Increased economic activity and higher weather-related natural gas demand also led to improvements in income for the rate-regulated energy segment. However, declining domestic oil production continued to restrain upstream petroleum industry earnings growth, despite a moderate rise in crude oil prices.

33040 (IEE-SR–241) **Post-cold war European energy markets.** Institute of Energy Economics, Tokyo (Japan). 25 Mar 1993. 112p. (In Japanese). Order Number DE93520813. Source: OSTI; NTIS; Available from The Institute of Energy Economics, Dai 10 Mori Biru, 18-1, Toranomon 1-chome, Minato-ku, Tokyo,Japan.

This paper details results of analyses on the current status of the post-cold war European energy markets, itemized as follows: The EC integration in confusion, and the political and economic circumstances in the European countries; integration of the EC energy markets and trends in the European energy markets (summary of the European energy demand and supply, summary of the European energy markets, the EC energy market integration, the market integration as seen by energy sources, and prospects of the EC energy market integration); market economy addressed in East Europe and the former Soviet and the European energy markets (the East European energy markets making sudden changes, progress of market economy in the energy department, and the European energy charter and the European energy markets); energy situations in the East European countries (Hungary, the former Czechoslovakia, Poland, Rumania, and Bulgaria); the demand and supply prospects made by the EC Committee over the European energy markets, and an outlook and problems in petroleum and natural gas as revealed in the above demand and supply prospects. 43 figs., 59 tabs.

2950 Hydrogen and Synthetic Fuels

33041 (UCRL-JC–113664) **Statement of David E. Baldwin, Associate Director for Energy, Lawrence Livermore National Laboratory and John C. Crawford, Vice President, Sandia National Laboratories, California, to the Subcommittee on Research and Development of the Committee on Environment and Public Works, United States Senate, Washington, DC, March 22, 1993.** Baldwin, D.E. (Lawrence Livermore National Lab., CA (United States)); Crawford, J.C. Lawrence Livermore National Lab., CA (United States). 18 Mar 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9303105–2: 1993 federal environmental restoration conference, Washington, DC (United States), 25-27 Mar 1993). Order Number DE93017991. Source: OSTI; NTIS; INIS; GPO Dep.

Testimony was submitted to the Senate on the environmental impacts of accelerated research and development of hydrogen-based energy systems. The advantages of hydrogen in transportation systems, in fuel cells for electric vehicles and power plants, and in energy storage from off-peak electricity production were described. The largest barrier to using hydrogen in the transportation sector is the on-board storage of enough fuel to provide an adequate driving range in an urban environment. Production methods and costs were also discussed. The authors believe a coordinated demonstration program with US industry is needed to develop the best technologies for hydrogen-fueled vehicles.

2960 Electric Power

Refer also to citation(s) 32795, 32963, 32976, 33005, 33026, 33036, 33063, 33073, 33074, 33075, 33076

33042 (NEI-DK–1265) **Potentials for hydroelectric power and the giving of priority to the development of hydroelectric power in Greenland.** Groenlands Energiforsyning, Copenhagen (Denmark). Vandkraftafd. Mar 1992. 135p. (In Danish). Order Number DE93525251. Source: OSTI; NTIS.

The aim was to update hydroelectric power potentials in Greenland, to assign priorities to the future development of the same and to present a summary of the hydroelectric plants that are currently planned to be developed in a specific areas. These potentials are divided between 14 projected plants of 250 GWh/yr, which could be established near town sites, and 16 potential plants with a larger capacity which could also be used to supply energy intensive industries or energy storage systems. The giving of priorities for development is based on socio-economic calculations where continued supply via diesel systems is compared with the use of

hydroelectricity. Investments and operational costs are dealt with. It is concluded that, based on socio-economic considerations, the most interesting sites for potential hydroelectric plants would be Qaqortog/Narsaq - Qorlortorsuaq (operational start: 1997 - 1999), Qeqertarsuaq - Kuussuuaq (start: 1998 - 2000) and Tasiilaq - Aammangaaq (start: 1999 - 2001). It would be most sensible to initiate hydroelectric power at a time when larger investments in the repair of existing diesel plants would be under consideration. With regard to other named towns, the establishment of hydroelectric power plants would hardly be interesting, seen from a socio-economic viewpoint, before quite a number of years have passed. If the energy demand or the oil prices should increase dramatically the subject could be taken up for renewed consideration. (AB)

2980 Consumption and Utilization

Refer also to citation(s) 33005, 33029

33043 (LBL–32822-Rev.2) **China energy databook: Revision 2, 1992 edition.** Sinton, J.E. (Lawrence Berkeley Lab., CA (United States)); Levine, M.D.; Liu, Feng; Davis, W.B. (eds.); Jiang Zhenping; Zhuang Xing; Jiang Kejun; Zhou Dadi (eds.). Lawrence Berkeley Lab., CA (United States); State Planning Commission of China, Beijing, BJ (China). Energy Research Inst. Jun 1993. 342p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93016706. Source: OSTI; NTIS; INIS; GPO Dep.

The Energy Analysis Program at the Lawrence Berkeley Laboratory (LBL) first became involved in Chinese energy issues through a joint China-US symposium on markets and demand for energy held in Nanjing in November of 1988. Discovering common interests, EAP began to collaborate on projects with the Energy Research Institute of China's State Planning Commission. In the course of this work it became clear that a major issue in the furtherance of our research was the acquisition of reliable data. In addition to other, more focused activities-evaluating programs of energy conservation undertaken in China and the prospects for making Chinese industries more energy-efficient, preparing historical reviews of energy supply and demand in the People's Republic of China, sponsoring researchers from China to work with experts at LBL on such topics as energy efficiency standards for buildings, adaptation of US energy analysis software to Chinese conditions, and transportation issues, we decided to compile, assess, and organize Chinese energy data. We are hopeful that this volume will not only help us in our work, but help build a broader community of Chinese energy policy studies within the US. In order to select appropriate data from what was available we established several criteria. Our primary interest was to use the data to help understand the historical evolution and likely future of the Chinese energy system. A primary criterion was thus that the data relate to the structure of energy supply and demand in the past and indicate probable developments (e.g., as indicated by patterns of investment). Other standards were accuracy, consistency with other information, and completeness of coverage. This is not to say that all the data presented herein are accurate, consistent, and complete, but where discrepancies and omissions do occur we have tried to note them.

33044 (LBL–34174) **Residential energy use in Mexico: Structure, evolution, environmental impacts, and savings potential.** Masera, O.; Friedmann, R.; deBuen, O. Lawrence Berkeley Lab., CA (United States); California Univ., Berkeley, CA (United States). Universitywide Energy Research Group. May 1993. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93019102. Source: OSTI; NTIS; GPO Dep.

This article examines the characteristics of residential energy use in Mexico, its environmental impacts, and the savings potential of the major end-uses. The main options and barriers to increase the efficiency of energy use are discussed. The energy analysis is based on a disaggregation of residential energy use by end-uses. The dynamics of the evolution of the residential energy sector during the past 20 years are also addressed when the information is available. Major areas for research and for innovative decision-making are identified and prioritized.

33045 (NEDO-P–9229) **Survey of actual status of energy consumption in the residential sector.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1993. 225p. (In Japanese). Sponsored by New Energy and Industrial Technology Development Organization, Tokyo (Japan). Order Number DE93520885. Source: OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan.

A survey is made on the actual status of the 1988 residential use energy consumption to prepare basic data for development/introduction of new energy and petroleum substitution energy. The average energy consumption unit requirement of 6 cities (Sapporo, Tokyo, Nagoya, Osaka, Takamatsu and Fukuoka) is 11,159 Mcal/household-year, in which town gas, electricity, kerosene and LPG are 39%, 28% 29% and 4%, respectively. The residential energy is used mostly for hot water supply (35%) and space heating (35%), followed by lighting/power, kitchen and space cooling. The consumption unit requirement by city is the largest in Sapporo, where space heating use kerosene has a large effect. Tokyo is below the average level of the 6 cities and has a town gas ratio of 53%. Takamatsu is the smallest in consumption and high in electricity ratio. The average consumption unit requirement of the 6 cities increases by 5.6% as compared with that in 1987. In energy source, electricity, LPG and kerosene increase while town gas and others decrease. Changes in space cooling demand are consistent with those in space cooling degree day and develop into wide spread of the equipment and the multi-consumption structure. 170 figs., 25 tabs.

33046 (NYSERDA–93-8) **Evaluation and demonstration of decentralized space and water heating versus centralized services for new and rehabilitated multifamily buildings: Final report.** Belkus, P. (Foster-Miller, Inc., Waltham, MA (US)); Tuluca, A. New York State Energy Research and Development Authority, Albany, NY (United States); Foster-Miller, Inc., Waltham, MA (United States); Winter (Steven) Associates, Inc., Norwalk, CT (United States); National Conference of States on Building Codes and Standards, Inc., Herndon, VA (United States). Jun 1993. 362p. Sponsored by New York State Energy Research and Development Authority, Albany, NY (United States). Source: OSTI; New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, NY 12223.

The general objective of this research was aimed at developing sufficient technical and economic know-how to convince the building and design communities of the appropriateness and energy advantages of decentralized space and water heating for multifamily buildings. Two main goals were established to guide this research. First, the research sought to determine the cost-benefit advantages of decentralized space and water heating versus centralized systems for multifamily applications based on innovative gas piping and appliance technologies. The second goal was to ensure that this information is made available to the design community.

2990 Unconventional Sources and Power Generation

Refer also to citation(s) 32682, 33026, 33042

33047 (ADEME–91-09-DOC-2) **World potential of renewable energies.** Dessus, B.; Devin, B.; Pharabod, F. Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. 50p. (In French). Order Number DE93000816. Source: OSTI; NTIS (US Sales Only).

A comprehensive analysis, region by region, of the actually accessible renewable energies at a given horizon, is presented. The same methodology as the one employed to derive "proven fossil energy reserves" from "energy resources" is adopted, in which resources are defined by quantitative information on physical potential, while reserves take into account technical and economical accessibility. As renewable resources are fluctuating with time and are diluted in space and not readily transportable or storeable, it is necessary to consider the presence of populations or activities near enough to be able to profit by these diluted and volatile energies.

33048 (DOE/FTR–93016673) **Travel to Mexico and Guatemala to discuss renewable energy programs and projects: Foreign trip report, May 18–30, 1993.** Flowers, L.T. National Renewable Energy Lab., Golden, CO (United States). 1 Jul 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE93016673. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Short communication. WIND POWER/research programs; TRAVEL; MEXICO; GUATEMALA; ELECTRIC UTILITIES; RURAL AREAS; PERFORMANCE

33049 (NEI-DK–1271) **Report on the status of renewable energy in Denmark.** Energistyrelsen, Copenhagen (Denmark). VE-Raadet. Mar 1993. 19p. (In Danish). Order Number DE93525261. Source: OSTI; NTIS.

The Committee for Renewable Energy (VE-Raadet) aims to promote the use of renewable energy in Denmark and suggests activities which should meet the goals of Energiplan 2000 - which illuminates Danish environmental and energy policy. The committee is responsible for the content of the section of the publication which surveys results in the light of Danish energy policy and evaluates future possibilities, it also points out the barriers to future development, and how they may be overcome. The Danish Energy Agency is responsible for the more factual information. The development of wind power energy regressed during 1992 mainly due to problems in finding suitable sites for wind turbines and to regulations related to connection to the electric-power distribution network. Currently, only one third of waste biomass is used for energy purposes, whereas the use of natural gas has increased. The main barrier to the development of the use of solar energy is the the cost of production of solar equipment. VE-Raadet recommends an overall coordination of energy planning to include all forms of renewable energy and involving the ministries for energy, the environment and transport. These points are briefly elaborated. (AB)

30 DIRECT ENERGY CONVERSION

3001 MHD Generators

Refer also to citation(s) 32546

33050 (DOE/FTR–93014703) **Travel to France for presentation of paper on MHD coal combustor: Foreign trip report, September 28–October 6, 1991.** Norton, O.P. Mississippi State Univ., MS (United States). 18 Nov 1991. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-80ET15601. Order Number DE93014703. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A paper entitled "Numerical Flow Simulation in the Slogging Stage of an MHD Coal Combustor" was presented at an international scientific conference on "Energy Transfer in Magnetohydrodynamic Flows." The conference was held at the Cadaracfie Center of the Commissariat a l'Energie Atomique, the French government atomic energy research organization. The other papers presented at this conference covered a wide range of applications of magnetohydrodynamics (MHD), including liquid metal MHD power generation, liquid metal MHD pumps, MHD propulsion in seawater, open cycle coal fired MHD, noble gas MHD, and metallurgical applications of MHD.

33051 (DOE/FTR–93017324) **Travel to Australia for the 27th meeting of the International liaison Group on magnetohydrodynamics electrical power generation: Foreign trip report, July 5–July 15, 1991.** Staats, G.E. USDOE Pittsburgh Energy Technology Center, PA (United States). Aug 1991. 21p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93017324. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The traveler attended the Plasma Technology Conference sponsored by the Electricity Commission of New South Wales. The discussion centered on plasma technology, which included the latest commercial applications of arc technology; i.e., mobile plasma arc furnace, fly-ash vitrification, drying application with superheated steam, direct reduction of iron ore, coal-fired boiler ignitor, surface coating, and metal surface treatment for wear resistance. In addition, many aspects of MHD were also covered including retrofit studies from several countries (Italy, United States, Japan, Australia), progress on MHD superconducting magnets in Italy, and various aspects of MHD channel plasma phenomena.

33052 (DOE/PC/90274–T21) **MHD Integrated Topping Cycle Project: Twentieth quarterly technical progress report, May 1, 1992–July 31, 1992.** TRW Space and Electronics Group, Redondo Beach, CA (United States). Applied Technology Div. Apr 1993. 54p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-87PC90274. (MHD-ITC–92-236). Order Number DE93040521. Source: OSTI; NTIS; GPO Dep.

Manufacturing, assembly, and checkout of combustion subsystem hardware was completed, and the hardware delivered to CDIF along with the water electrical isolators. A successful nozzle proof test was concluded; purpose was to evaluate adequacy of the nozzle structure and sealing of sidewall-to-electrode wall joints, water tubes, and stud and wire penetrations at operating pressure. Design modifications to spare channel inlet frame were made to enable iron oxide injection. Results of tests in the CDIF 1A1 channel which compared effect of different cathode wall iron oxide injection locations indicated that injection through the side port may be more effective, particularly if one of the two ports become clogged. Design confirmation testing of a pneumatically driven ram to clear a plugged iron oxide injector tip was performed. Manufacture of spare and replacement parts for 1A4 channel and diffuser was begun. Construction of the cathode power cabinets and associated control system was completed. Hot-fire checkout series was completed for the combustion subsystem; 16.8 thermal hours were accumulated during 7 tests. This test series demonstrated adequacy of overall cooling of combustion subsystem and provided an initial evaluation of heat losses and slagging characteristics. Several major facility activities at the CDIF were accomplished including installation and testing of new iron oxide pumps, initial on-line checkout of coal feed system modifications, modification of seed system including replacement of silo rotary feeder, installation of new filter receiver on the silo, and conversion of fly ash bin to dust collector, removal of all of the electrical wiring (used for 1A1 channel) between the channel and HVR in order to install 1A4 wiring, and installation of the 1A4 channel.

33053 (DOE/PC/90274–T22) **MHD Integrated Topping Cycle Project: Twenty-first quarterly technical progress report, August 1, 1992–October 31, 1992.** TRW Space and Electronics Group, Redondo Beach, CA (United States). Applied Technology Div. Apr 1993. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-87PC90274. (MHD-ITC–93-040). Order Number DE93040520. Source: OSTI; NTIS; GPO Dep.

Combustor spare and contingency hardware was shipped to the CDIF. Manufacture of spare and replacement hardware for the IA4 channel and diffuser continued. Fabrication of a modified/spare channel inlet frame which enables iron oxide injection. The cathode power cabinets and associated control system were successfully tested at Westinghouse and met all design requirements. The cathode system was delivered to the CDIF and installed in the current consolidation building. With the delivery of tills component, all prototypical power train components have been delivered to the CDIF. The hot-fire checkout of the channel subsystem and the design verification test series of the integrated power train were completed. A total of 29 tests were performed accumulating 120 thermal and 52 electrical hours. The test series demonstrated the adequacy of the overall cooling of the channel subsystem and provided an initial evaluation of the integrated combustor and channel performance in terms of operating conditions, power output, conductivity, heat loss, slagging behavior, and gas-side wear characteristics. During the test series localized wear in the supersonic nozzle was observed on the right sidewall. Cause of wear is being investigated. At conclusion of DVT test series, the channel was removed for inspection.

33054 (DOE/PC/90274–T23) **MHD Technology Transfer, Integration and Review Committee: Seventh semi-annual status report, April 1991–September 1991.** TRW Space and Technology Group, Redondo Beach, CA (United States). Applied Technology Div. Feb 1993. 136p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-87PC90274. (MHD-ITC–93-017). Order Number DE93040519. Source: OSTI; NTIS; GPO Dep.

This seventh semi-annual status report of the MHD Technology Transfer, Integration and Review Committee (TTIRC) summarizes activities of the TTIRC during the period April 1991 through September 1991. It includes a summary and minutes of the General Committee meeting, progress summaries of ongoing POC contracts, discussions pertaining to technical integration issues in the POC program, and planned activities for the next six months. The meeting included test plan with Western coal, seed regeneration economics, power management for the integrated topping cycle and status of the Clean Coal Technology Proposal activities. Appendices cover CDIF operations HRSR development, CFFF operations etc.

3003 Thermoelectric Generators

Refer also to citation(s) 32629, 32631

33055 (DOE/NE/32115–T1) **Special Applications RTG Technology Program: Thermoelectric module development summary report.** Brittain, W.M. Teledyne Energy Systems, Timonium, MD (United States). Sep 1988. 110p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC01-83NE32115. (TES–32115-194). Order Number DE93017020. Source: OSTI; NTIS; GPO Dep.

The primary objective of the Special Applications thermoelectric module development program is to design, develop and demonstrate the performance of a module which provides a significant thermoelectric conversion efficiency improvement over available technology for low power, relatively high voltage RTGS intended for terrestrial applications. "Low power" can be construed as an RTG power output of 10 watts or less, and "high voltage" can be considered as a load voltage of 5 volts or greater. In particular, the effort is to improve the system efficiency characteristic of the state-of-the-art bismuth telluride-based RTG system (e.g., Five-Watt RTG and Half-Watt RTG), typically 3 to 4%, to the range of 6% or better. This increase in efficiency will also permit reductions in the weight and size of RTGs in the low power range.

3004 Thermionic Converters

33056 (NEDO-P–9212) **Feasibility survey of thermoelectric conversion technology using semiconductors.** New Energy and Industrial Technology Development Organization, Tokyo (Japan). Mar 1993. 105p. (In Japanese). Sponsored by New Energy and Industrial Technology Development Organization, Tokyo (Japan). Order Number DE93520882. Source: OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan.

The paper takes notice to thermoelectric conversion technology using semiconductors and investigates it in a wide range from high temperature to low temperature to study its feasibility. It is found that in Bi-Te alloy elements applicable to a temperature range of around 200°C, some are over $3.5 \times 10^{-3} K^{-1}$ in performance index, and performance of the element can be practically improved in the near future. The thermoelectric power generation system using waste heat from the fuel cell power plant, which is 5-6% in conversion efficiency, can generate output more than 100kW and is expected to improve by approximately 1% in plant overall efficiency. The construction cost, however, is around 1.6-1.9 million yen/kW. The thermoelectric power generation plant which is modeled on No.2 generator of Hatchobaru geothermal power plant can generate electric output of 10-12.5MW, which is smaller than that of the conventional geothermal power generation. The construction cost is around 3.2-4.1 million yen/kW. Even if advantage of the system in running cost is considered, attractive systematization seems to be difficult. 88 refs., 81 figs., 17 tabs.

3005 Fuel Cells

Refer also to citation(s) 32633, 32971, 33056

33057 (CEA-CONF–11207) **New electrodes for hydrogen/oxygen solid polymer electrolyte fuel cell.** Mosdale, R. (CEA Centre d'Etudes de Grenoble, 38 (France). Dept. de Recherche Fondamentale sur la Matiere Condensee); Stevens, P. CEA Centre d'Etudes de Grenoble, 38 (France). Dept. de Recherche Fondamentale sur la Matiere Condensee. 1992. 8p. (CONF-9209383–1: Congress on Solid State Ionics, Villard de Lans (France), 7-11 Sep 1992). Order Number DE93515348. Source: OSTI; NTIS (US Sales Only).

A new method of preparation of Electrode/Membrane/Electrode (EME) assemblies for Proton Exchange Membrane Fuel Cells (PEMFC) has been developed. The electrodes are deposited directly onto a Nafion electrolyte membrane from a mixture of platinized carbon, Nafion solution, and PTFE by using a spray technique. By this technique, porous electrodes are obtained with an optimized gas/electrolyte/catalyst interface, and electrode/membrane interface.

33058 (DOE/METC–93/4112) **Molten carbonate fuel cell networks: Principles, analysis, and performance: Technical note.** Wimer, J.G.; Williams, M.C. USDOE Morgantown Energy Technology Center, WV (United States). Jan 1993. 44p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93000281. Source: OSTI; NTIS; GPO Dep.

The chemical reactions in an internally reforming molten carbonate fuel cell (IRMCFC) are described and combined into the overall IRMCFC reaction. Thermodynamic and electrochemical principles are discussed, and structure and operation of fuel cell stacks are explained. In networking, multiple fuel cell stacks are arranged so that reactant streams are fed and recycled through stacks in series, for higher reactant utilization and increased system efficiency. Advantages and performance of networked and conventional systems are compared, using ASPEN simulations. The concept of networking can be applied to any electrochemical membrane, such as that developed for hot gas cleanup in future power plants. 2 tabs, 16 figs, 9 refs.

33059 (ECN-RX–93-083) **Molecular dynamics simulation of binary mixtures of molten alkali carbonates.** Tissen, J.T.W.M. (Unit ECN Fossil Fuels, Netherlands Energy Research Foundation, Petten (Netherlands)); Janssen, G.J.M.; Van der Eerden, J.P. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). Aug 1993. 34p. Order Number DE93524596. Source: OSTI; NTIS; Available from the library of the Netherlands Energy Research Foundation (ECN), P.O. Box 1, 1755 ZG Petten (Netherlands).

This research was part of the Ph.D. thesis of one of the authors, J.T.W.M. Tissen, University of Utrecht (NL).

Molecular Dynamics simulations have been performed of three binary eutectic mixtures: Li/KCO_3 (62-38 mol%), Li/KCO_3 (43-57 mol%) and Li/$NaCO_3$ (53-47 mol%) at 1200K. Thermodynamic, structural and dynamical changes upon mixing the alkali carbonates have been investigated. For the thermodynamic properties no significant deviations from linear additivity were found. The short-range order in the mixtures differs in many respects from the short-range order found in the pure components. The Li^+ ions are coordinated by a smaller number of oxygen atoms, the Na^+ and K^+ ions by a large number. The Li^+ ions become trapped in their first coordination shell, leaving relatively more space for the heavier atoms. This feature is the cause of the often-observed non-additivity of the dynamic properties of these mixtures. The Chemla effect in Li/KCO_3, the large negative deviations from linear additivity for the electrical conductivity, as well as the dependency of the self-diffusion of the cations on the Li_2CO_3 contents, can now be understood. 11 figs., 6 tabs., 28 refs.

33060 **Method and apparatus for monitoring fuel cell performance.** Blair, J.D.; Dircks, K. To Ballard Power Systems (Canada). 8 Dec 1992. Filed date 7 Jun 1991. Canada patent application 2064031. 42p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

A method and apparatus for monitoring the performance of fuel cells arranged in series involves the measurement and comparison of fuel cell performance indicators, such as voltage. In a first embodiment, the voltage across each fuel cell group is compared to a reference voltage equal to a predetermined minimum voltage. In a second embodiment, the voltage across each group is compared to a reference voltage equal to the average across all fuel cell

groups. In a third embodiment, a reference voltage equal to the voltage across one group is compared to the voltage across each of the other fuel cell groups. In a fourth embodiment, the voltage across each group is compared as a reference voltage to the voltage across an adjacent fuel cell group. Other embodiments comprising various combinations of the first, second, third, and fourth embodiments are also provided. An alarm is activated, and a supply of fuel to the cells discontinued, when the measured voltage for a fuel cell group varies from the reference voltage by more than a predetermined voltage differential. 4 figs.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

33061 (CONF-930895–) **International Energy and Environmental Congress: Proceedings.** Association of Energy Engineers, Atlanta, GA (United States). 1993. 266p. Sponsored by USDOE, Washington, DC (United States); Alliance to Save Energy, Washington, DC (United States); General Services Administration, Washington, DC (United States); Environmental Protection Agency, Washington, DC (United States); Association of E From international energy and environmental congress; Minneapolis, MN (United States); 4-5 Aug 1993. Order Number DE93040609. Source: OSTI; NTIS; INIS; GPO Dep.

This document contains information presented at the International Energy and Environmental Congress '93 proceedings. Symposiums included demand-side management strategic directions; federal energy management; corporate energy management; and pollution control technologies. Individual reports from the symposiums are processed separately for the data bases.

33062 (ORNL–6750) **Energy Division annual progress report for period ending September 30, 1992.** Counce, D.M.; Wolff, P.P. (eds.). Oak Ridge National Lab., TN (United States). Apr 1993. 266p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93019691. Source: OSTI; NTIS; GPO Dep.

Energy Division's mission is to provide innovative solutions to energy and related issues of national and global importance through interdisciplinary research and development. Its goals and accomplishments are described in this annual progress report for FY 1992. Energy Division's total expenditures in FY 1992 were $42.8 million. The work is supported by the US Department of Energy, the US Department of Defense, many other federal agencies, and some private organizations. Disciplines of the 116.5 technical staff members include engineering, social sciences, physical and life sciences, and mathematics and statistics. The division's programmatic activities cover three main areas: (1) analysis and assessment, (2) energy conservation technologies, and (3) military transportation systems. Analysis and assessment activities involve energy and resource analysis, preparation of environmental assessments and impact statements, research on waste management, technology transfer, analysis of energy and environmental needs in developing countries, and civilian transportation analysis. Energy conservation technologies focus on electric power systems, building envelopes (walls, foundations, roofs, attics, and materials), and methods to improve energy efficiency in existing buildings. Military transportation systems conduct research for sponsors within the US military to improve the efficiency of military deployment, scheduling, and transportation coordination. Much of Energy Division's research is valuable to other organizations as well as to sponsors. This information is disseminated by the staff's involvement in professional and trade organizations and workshops; joint research with universities and private-sector firms; collaboration with state and local governments; presentation of work at conferences; and publication of research results in journals, reports, and conference proceedings.

3201 Buildings

Refer also to citation(s) 32214, 32647, 32648, 32649, 32650, 32651, 32652, 32655, 32656, 32660, 32664, 32665, 32695, 32698, 32968, 33025, 33027, 33045, 33046, 33252, 33408, 33772, 33911

33063 (AFME–90-04-DOC) **Efficient end uses of electricity in the building sector.** Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). 1991. 316p. (In English, French). (CONF-9006446–: MUSE HT 90: Conference on efficient end uses of electricity in the building sector, Sophia Antipolis (France), 12-13 Jun 1990). Order Number DE94700003. Source: OSTI; NTIS (US Sales Only).

The main themes of the symposium are: consumptions, appliances stocks and potential savings in efficient specific end uses of electricity, cost of dissemination of electricity rational use concepts, electricity demand forecasts in building; examples of electricity consumption and conservation means in public buildings, offices (and esp. microcomputers), supermarkets, catering, and lighting systems; new household electric appliance technologies and standards, and their effects on electric power demand and consumption; energy conservation policies in various countries (EEC, USA-New York, Netherlands, Brazil, and global view) concerning electricity consumption in buildings.

33064 (AFME–90-04-DOC, pp. 19-45) **Electronic office equipment: a new sector for electricity conservation.** Roturier, J. (Bordeaux-1 Univ., 33 - Gradignan (France). Centre d'Etudes Nucleaires); Elkari, A.; Harris, J.P.; Tissier, J.L.; Diaz Pedregal, P. Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9006446–: MUSE HT 90: Conference on efficient end uses of electricity in the building sector, Sophia Antipolis (France), 12-13 Jun 1990). In *Efficient end uses of electricity in the building sector.* 316p. Order Number DE94700003. Source: OSTI; NTIS (US Sales Only).

The influence of the strong growth of PC-microcomputer utilization on electricity consumption in Europe is analyzed, based on the energy consumption data in two important office buildings in Paris: it is shown that, in terms of power demand and consumption, microcomputers appear at the same level as lighting; in terms of electricity production, 4 GW are required by the 18 millions PCs on duty in Europe; as the PCs park is assumed to be increased fourfold in Europe between 1988 and 1993, a 10 GW production is then required in 1993, an order of magnitude of the production capacity growth. Energy conservation means could reduce the PCs electricity consumption by a factor of two.

33065 (AFME–90-04-DOC, pp. 46-54) **Cost of dissemination of efficient electrical equipment versus price of kWh.** Dessus, B. (Centre National de la Recherche Scientifique (CNRS), 75 - Paris (France)). Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9006446–: MUSE HT 90: Conference on efficient end uses of electricity in the building sector, Sophia Antipolis (France), 12-13 Jun 1990). In *Efficient end uses of electricity in the building sector.* 316p. Order Number DE94700003. Source: OSTI; NTIS (US Sales Only).

Standardization of electricity pricing in many countries for social equality reasons, often generates deficits in some areas of these countries. In these areas, it is of electric utilities' interest to promote electricity conservation measures or even substitutes to electricity. Economical criteria for comparison of the production investments and conservation investments are proposed. The criteria are based on the discount rated deficit concept and are used by the electric utility to rank its priorities based on objective parameters. Examples for France are given.

33066 (AFME–90-04-DOC, pp. 55-71) **Electricity demand forecasts in buildings in 2010.** Angioletti, R. (Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France)). Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9006446–: MUSE HT 90: Conference on efficient end uses of electricity in the building sector, Sophia Antipolis (France), 12-13 Jun 1990). In *Efficient end uses of electricity in the building sector.* 316p. Order Number DE94700003. Source: OSTI; NTIS (US Sales Only).

Lighting and electro domestic energy consumption in dwellings have increased by 80 pc during 1975-1988, from 20.5 TWh/year to 36.9 TWh/year, when the residential park increased by only 18 pc. Household equipment increase, new comfort needs and new products have led to a 50 pc increase for the household specific mean power consumption. Under various assumptions concerning future energy efficiency enhancements for house equipment and various

socio-economical scenarios, potential energy consumption reductions are assessed as a function of household attitudes concerning energy conservation means.

33067 (AFME–90-04-DOC, pp. 86-93) **Efficient use of electricity by local authorities.** Mosdale, J. Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9006446–: MUSE HT 90: Conference on efficient end uses of electricity in the building sector, Sophia Antipolis (France), 12-13 Jun 1990). In *Efficient end uses of electricity in the building sector.* 316p. Order Number DE94700003. Source: OSTI; NTIS (US Sales Only).

The electricity specific utilizations by the local authorities (buildings, public lighting, etc.) are quantified and its various characteristics are reviewed and analyzed: the different Electricite de France tariffs for local authorities, the energy conservation means in buildings (inside and outside lighting, hot water production, motive power, cooking, laundry, etc.) and in public lighting (description of equipment and potential energy consumption reduction in public lighting). An overall energy conservation potential is assessed.

33068 (AFME–90-04-DOC, pp. 94-113) **Electronic office equipment: a new sector for electricity conservation.** Roturier, J. (Bordeaux-1 Univ., 33 - Gradignan (France). Centre d'Etudes Nucleaires). Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9006446–: MUSE HT 90: Conference on efficient end uses of electricity in the building sector, Sophia Antipolis (France), 12-13 Jun 1990). In *Efficient end uses of electricity in the building sector.* 316p. Order Number DE94700003. Source: OSTI; NTIS (US Sales Only).

Portable microcomputers may use CMOS technology in order to reduce energy consumption; however, the high cost of CMOS components is hindering their widespread use; other technologies that may be used to reduce energy consumption, such as in the portable MacIntosh, are presented. Two simple electronic circuits, developed at CENBG, that enhance energy efficiency of microcomputer peripherals (screens and printers), are described. The electricity consumption reduction that would be achieved through utilization of these different technologies is then grossly evaluated.

33069 (AFME–90-04-DOC, pp. 114-119) **Energy efficiency in UK supermarkets.** Ibbotson, P. (Sainsbury's, London (United Kingdom)). Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). 1991. (CONF-9006446–: MUSE HT 90: Conference on efficient end uses of electricity in the building sector, Sophia Antipolis (France), 12-13 Jun 1990). In *Efficient end uses of electricity in the building sector.* 316p. Order Number DE94700003. Source: OSTI; NTIS (US Sales Only).

The paper describes how improvements to lighting, refrigeration, heating ventilation and air conditioning in the Sainsbury supermarkets have given savings of 40 pc compared with earlier designs. Techniques such as heat recovery, digital controls and building energy management systems have been adopted in order to optimize the efficiency of all energy consuming services in the store. Moreover, recent research and development has resulted in the adoption of R22 for all refrigeration applications.

33070 (AFME–90-04-DOC, pp. 128-139) **Efficient lighting technologies and savings from submetered commercial retrofits.** Nilsson, P.E. (Chalmers Univ. of Technology, Goeteborg (Sweden)); Piette, M.A. Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). 1991. (CONF-9006446–: MUSE HT 90: Conference on efficient end uses of electricity in the building sector, Sophia Antipolis (France), 12-13 Jun 1990). In *Efficient end uses of electricity in the building sector.* 316p. Order Number DE94700003. Source: OSTI; NTIS (US Sales Only).

This paper gives an overview of new technologies aiming at reducing lighting energy use in commercial buildings, and of measured savings from seven case studies in retrofitted commercial buildings; component characteristics of efficient lighting systems are described, concerning lamps, ballasts, fixtures, and controls. One noticeable product is the solid-state ballast which overcomes by 25 pc the core-coil ballast efficiency; another is the specular reflector, which can increase the light output from a fixture by 15 pc over fixtures with diffuse reflector materials. Computer controlled scheduling, daylight dimming or occupancy sensors can also achieve substantial savings in new and existing buildings.

33071 (AFME–90-04-DOC, pp. 208-220) **Economic and energy demand impacts of U.S. appliance efficiency regulations on consumers, manufacturers and electric utilities.** McMahon, J.E. (Lawrence Berkeley Lab., CA (United States)); Berman, D.; Chan, P.; Chan, T.; Koomey, J.G.; Levine, M.L.; Stoft, S. Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). 1991. (CONF-9006446–: MUSE HT 90: Conference on efficient end uses of electricity in the building sector, Sophia Antipolis (France), 12-13 Jun 1990). In *Efficient end uses of electricity in the building sector.* 316p. Order Number DE94700003. Source: OSTI; NTIS (US Sales Only).

This paper summarizes the projected impacts of the national mandatory program on consumers, manufacturers, electric utilities, and the environment from 1990 through 2015: design and production of appliances may change, affecting the financial status of manufacturers; appliance purchasers (consumers, builders, and landlords) may face changes in prices and operating expenses; most of the energy savings concern electricity, affecting electric utilities; emissions of pollutants are expected to be diminished, as a result of the improved efficiency of the end-use technologies. Computer models are used to evaluate costs faced by consumers, financial impacts on manufacturers, energy savings by fuel type and by end-use, capacity growth and electric utility revenues, and emissions of CO2, NOx and SOx.

33072 (AFME–90-04-DOC, pp. 256-264) **The potential for electricity conservation in the state of New York, USA.** Eto, J.H. (American Council for an Energy-Efficient Economy, Washington, DC (United States)); Miller, P.M.; Geller, H.S. Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). 1991. (CONF-9006446–: MUSE HT 90: Conference on efficient end uses of electricity in the building sector, Sophia Antipolis (France), 12-13 Jun 1990). In *Efficient end uses of electricity in the building sector.* 316p. Order Number DE94700003. Source: OSTI; NTIS (US Sales Only).

The potential for electricity conservation in the residential, commercial and industrial sectors of the state of New York, accounting for 35%, 40% and 21% respectively of electrical sales (100 TWh in 1986), is examined. The energy savings that would result from implementation of 62 energy conservation measures are quantified, and the measures are ranked according to their cost and aggregate energy savings. Costs include the direct capital and labor costs of installing the measures. Substantial electricity savings would be available at costs less than the marginal cost of new supplies: reductions of 34%, 47% and 16% in the electricity consumed by the three sectors could be achieved.

33073 (AFME–90-04-DOC, pp. 265-270) **Program for electricity savings in the Netherlands.** Derks, R. (Netherlands Agency for Energy and the Environment, Sittard (Netherlands)). Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). 1991. (CONF-9006446–: MUSE HT 90: Conference on efficient end uses of electricity in the building sector, Sophia Antipolis (France), 12-13 Jun 1990). In *Efficient end uses of electricity in the building sector.* 316p. Order Number DE94700003. Source: OSTI; NTIS (US Sales Only).

A description is given of the electricity savings programme set up by NOVEM by order of the government. Only preliminary results are given. The objective is to reach 20% better energy efficiency by the year 2000. The second part of the programme is encouraging shift from electrical appliances to gas appliances (provided the net result is beneficial to the environment). The third part aims at stimulating Demand Side Management Programmes. The paper describes the results achieved up till now, as it started in 1990.

33074 (AFME–90-04-DOC, pp. 271-278) **Electricity savings in buildings in the Netherlands.** Trines, R.L. (Netherlands Agency for Energy and the Environment, Sittard (Netherlands)). Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). 1991. (CONF-9006446–: MUSE HT 90: Conference on efficient end uses of electricity in the building sector, Sophia Antipolis (France), 12-13 Jun 1990). In *Efficient end uses of electricity*

in the building sector. 316p. Order Number DE94700003. Source: OSTI; NTIS (US Sales Only).

A general view of new activities in Holland to save electricity in dwellings, public buildings and street lighting, is presented. In order to rapidly control environmental problem, a saving of the total electricity consumption by at least 20% is to be accomplished by the year 2000. Novem has made a plan to accomplish at least 20% saving in public buildings and 30% in houses and street lighting through fuel and appliance substitution, automation, energy management, improved fans, hybrid gas/solar boilers, new standards, etc.

33075 (AFME–90-04-DOC, pp. 279-289) **Electric power saving in Brazil. An agenda for the 1990's.** Cunha, F.A. (Companhia Energetica de Sao Paulo, SP (Brazil)); Silvestrin, C.R. Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). 1991. (CONF-9006446–: MUSE HT 90: Conference on efficient end uses of electricity in the building sector, Sophia Antipolis (France), 12-13 Jun 1990). In *Efficient end uses of electricity in the building sector.* 316p. Order Number DE94700003. Source: OSTI; NTIS (US Sales Only).

A synthetic approach of the development of the Brazilian electrical sector, with emphasis on the importance of power saving in the state of Sao Paulo and details on the CESP program, is presented. Reference targets and basic action lines are described for the various market segments, as well as the main results expected. Power efficiency enhancement is the main objective, with power savings among users as the mean to improve the quality of products and services.

33076 (AFME–90-04-DOC, pp. 290-305) **A review of national policies concerning building sector electric power utilization and conservation.** Michel, P. (Ecole Nationale des Travaux Publics de l'Etat, 69 - Vaulx-en-Velin (France)). Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9006446–: MUSE HT 90: Conference on efficient end uses of electricity in the building sector, Sophia Antipolis (France), 12-13 Jun 1990). In *Efficient end uses of electricity in the building sector.* 316p. Order Number DE94700003. Source: OSTI; NTIS (US Sales Only).

In all industrial countries, electricity demand has been increasing for the last two decades, while oil demand remained roughly constant; growth is due to rapid introduction of electric technologies, flexibility and reliability of electricity supplies, energy substitution or changes in life styles. Instead of increasing generation capacity, some governments and utilities have stimulated electricity end-use efficiency improvements, implementing energy policies and programmes based on pricing, information, financial incentives, regulation, and research and development. Economical and environmental justifications can be found to these options, with good examples given by Canada, in spite of relative abundance, and Sweden which prepares the phasing out of its nuclear power before 2010.

33077 (BNL–52340) **Proceedings of the 1991 Oil Heat Technology Conference and Workshop.** McDonald, R.J. Brookhaven National Lab., Upton, NY (United States). Jul 1992. 200p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9109152–: Oil heat technology conference and workshop, Upton, NY (United States), 30 Sep - 1 oct 1991). Order Number DE93018814. Source: OSTI; NTIS; GPO Dep.

This Conference, which was the sixth held since 1984, is a key technology-transfer activity supported by the ongoing Combustion Equipment Technology program at BNL, and is aimed at providing a forum for the exchange of information among international researchers, engineers, manufacturers, and marketers of oil-fired space-conditioning equipment. The objectives of the Conference were to: Identify and evaluate the state-of-the-art and recommend; new initiatives to satisfy consumer needs cost-effectively, reliably, and safely; Foster cooperation among federal and industrial representatives with the common goal of national security via energy conservation. The 1991 Oil Technology Conference comprised: (a) two plenary sessions devoted to presentations and summations by public and private sector representatives from the United States, Europe, and Canada; and, (b) four workshops which focused on mainstream issues in oil-heating technology. Selected papers have been processed separately for inclusion in the Energy Science and Technology Database.

33078 (CONF-930842–1) **Advancing weatherization performance: Measured results from the North Carolina field test of an advanced measure selection technique.** Sharp, T.R. Oak Ridge National Lab., TN (United States). [1993]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 6. international conference on energy program evaluation: uses, methods and results; Chicago, IL (United States); 23-27 Aug 1993. Order Number DE93017860. Source: OSTI; NTIS; GPO Dep.

The field performance of weatherizations based on a newly-developed advanced residential energy conservation measure selection technique was tested alongside current Retro-Tech-based weatherizations in North Carolina. The two weatherization approaches were compared based on implementation ease, measures installed, labor and cost requirements, and energy savings achieved. One-hundred twenty low-income, single-family households served by three different weatherization agencies participated in the field test which was conducted between June 1989 and August 1991. Average heating energy savings were 33% for weatherizations based on the new technique and 23% for Retro-Tech-based weatherizations. Weatherizations based on the new technique achieved 43% more heating energy savings, cost around 10% less at two weatherization agencies and considerably more at the third, and were near equivalent in labor requirements. Major findings from the study include: (1) the advanced audit will install some measures in near identical quantities as Retro-Tech-based weatherizations and others in dramatically different quantities, (2) the advanced audit can significantly increase heating energy savings, (3) blower-door-directed air sealing can more than double the air leakage reductions achieved from standard air sealing techniques, (4) North Carolina low-income houses have much higher average leakage rates than similar New York houses but can be sealed as well or better, and (5) using the advanced audit will not increase weatherization costs and may actually lower costs for most weatherization agencies.

33079 (CONF-930842–2) **Evaluation of a lighting program for small commercial and industrial buildings in the northeast.** MacDonald, M. (Oak Ridge National Lab., TN (United States)); Trumble, D.; Farley, J. Oak Ridge National Lab., TN (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 6. international conference on energy program evaluation: uses, methods and results; Chicago, IL (United States); 23-27 Aug 1993. Order Number DE93017866. Source: OSTI; NTIS; GPO Dep.

An impact evaluation of a commercial lighting retrofit program of COM/Electric is briefly described, together with the methodological development required for the evaluation. The evaluation is conducted for a large sample of buildings (over 1,000 treatment and over 200 control buildings) using whole-building electric billing data. Historic modeling approaches - Annual or Seasonal Aggregate Model, Building Specific Thermal Model (e.g. PRISM), and Pooled Factors Model - are discussed, and an extension of PRISM is presented. The methods presented provide some useful methodological insight, and further work could be conducted to make improvements. The energy savings are evaluated using several methods. Overall, results indicate that adjusted program first-year investment cost ratio, the ratio of total costs to first-year adjusted electricity savings, is about $0.60/kWh. First-year investment cost is greater for larger total investments in buildings than for smaller investments.

33080 (CONF-930842–3) **DOE's Weatherization Assistance Program: National impacts and regional variations.** Brown, M.A.; Berry, L.G.; Balzer, R.A. Oak Ridge National Lab., TN (United States). [1993]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 6. international conference on energy program evaluation: uses, methods and results; Chicago, IL (United States); 23-27 Aug 1993. Order Number DE93017756. Source: OSTI; NTIS; GPO Dep.

Since 1976, the USDOE has operated one of the largest energy conservation programs in the nation – the low-income Weatherization Program. DOE Weatherization strives to increase the energy efficiency of dwellings occupied by low-income persons, in order to reduce their energy consumption, lower their fuel bills, increase the comfort of their homes, and safeguard their health. It targets vulnerable groups including the elderly, people with disabilities, and families with children. The most recent national evaluation of the impacts of DOE Weatherization examined the energy consumption of households weatherized in 1981. DOE Weatherization regulations and operations have changed substantially since then: new funding sources, management principles, diagnostic procedures, and weatherization technologies have been incorporated. Many of these new features have been studied in isolation or at a local level; however, no recent evaluation has assessed their combined, nationwide impacts or their potential for the future. In 1990, DOE initiated such a national evaluation. The evaluation is comprised of three "impact" studies and two "policy" studies. Altogether, these five studies will provide a comprehensive national evaluation of the Weatherization Program. This paper presents the results of the first phase of the Single-Family Study. It evaluates the energy savings and cost effectiveness of DOE Weatherization as it has been applied to the largest portion of its client base – low-income households occupying single-family dwellings, mobile homes, and small (2- to 4-unit) multifamily dwellings. In addition to the primary goals of estimating energy savings and cost effectiveness, the study has three secondary goals: assess non-energy impacts, such as employment and environmental benefits; analyze factors associated with energy savings and cost effectiveness; and identify promising weatherization opportunities for the future.

33081 (DOE/CE/15501–T8) **Commercial high efficiency dehumidification systems using heat pipes.** Heat Pipe Technology, Inc., Alachua, FL (United States). [1993]. 152p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-91CE15501. Order Number DE93040017. Source: OSTI; NTIS; GPO Dep.

An improved heat pipe design using separately connected two-section one-way flow heat pipes with internal microgrooves instead of wicks is described. This design is now commercially available for use to increase the dehumidification capacity of air conditioning systems. The design also includes a method of introducing fresh air into buildings while recovering heat and controlling the humidity of the incoming air. Included are applications and case studies, load calculations and technical data, and installation, operation, and maintenance information.

33082 (DOE/CE/23810–20) **Materials Compatibility and Lubricants Research of CFC-refrigerant substitutes: Quarterly technical progress report, 1 April 1993–30 June 1993.** Godwin, D.S.; Hourahan, G.C.; Szymurski, S.R. Air-Conditioning and Refrigeration Technology Inst., Inc., Arlington, VA (United States). Jul 1993. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91CE23810. Order Number DE93040220. Source: OSTI; NTIS; GPO Dep.

The Materials Compatibility and Lubricants Research (MCLR) program supports critical research to accelerate the introduction of CFC and HCFC refrigerant substitutes. The DCLR program addresses refrigerant and lubricant properties and materials compatibility. The primary elements of the work include data collection and dissemination, materials compatibility testing, and methods development. The work is guided by an Advisory Committee consisting of technical experts from the refrigeration and air-conditioning industry and government agencies. Under the current MCLR program the Air-Conditioning and Refrigeration Technology Institute, Inc., (ARTI) is contracting and managing multiple research projects and a data collection and dissemination effort. Detailed results from these projects are reported in technical reports prepared by each researcher.

33083 (DOE/CE/23810–20C) **Measurement of viscosity, density, and gas solubility of refrigerant blends in selected synthetic lubricants: Quarterly report, March 1–June 30, 1993.** Cavestri, R.C. Imagination Resources, Inc., Dublin, OH (United States). Jul 1993. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91CE23810. Order Number DE93040221. Source: OSTI; NTIS; GPO Dep.

Liquid/liquid miscibilities of four different 32 ISO VG polyoresters and one alkylbenzene at three concentrations has been determined with five refrigerant blends, one blend comprising HC-290. A vapor lubricant equilibrium (VLE) viscosity reduction of 32 ISO VG mineral oil with HCFC-22 has been completed. Composite Viscosity reduction information by the fractionate components from R-502 in 32 ISO VG mineral oil has been obtained from −10°C (14°F) to 125°C (257°F) isotherms.

33084 (DOE/CE/23821–T1) **Characterization of commercial building appliances: Final report.** Patel, R.F.; Teagan, P.W.; Dieckmann, J.T. Little (Arthur D.), Inc., Cambridge, MA (United States). Aug 1993. 209p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC01-90CE23821. Order Number DE93019344. Source: OSTI; NTIS; GPO Dep.

This study focuses on "other" end-uses category. The purpose of this study was to determine the relative importance of energy end-use functions other than HVAC and lighting for commercial buildings, and to identify general avenues and approaches for energy use reduction. Specific energy consuming technologies addressed include non-HVAC and lighting technologies in commercial buildings with significant energy use to warrant detailed analyses. The end-uses include office equipment, refrigeration, water heating, cooking, vending machines, water coolers, laundry equipment and electronics other than office equipment. The building types include offices, retail, restaurants, schools, hospitals, hotels/motels, grocery stores, and warehouses.

33085 (DOE/ER/30155–H1) **A research needs assessment: Energy efficient alternatives to chlorofluorocarbons (CFCs): Final reprot.** Little (Arthur D.), Inc., Cambridge, MA (United States). Jun 1993. 260p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC01-91ER30155. Order Number DE93019589. Source: OSTI; NTIS; GPO Dep.

An assessment of the state of the art in refrigeration and insulation technologies is carried out to evaluate the potential for efficient substitutes for CFCs and HCFCs to facilitate the transition to a CFC-free environment. Opportunities for improved efficiency in domestic refrigeration, building chillers, commercial refrigeration and industrial refrigeration are evaluated. Needs for alternate refrigerants, improved components, and/or alternate cycles are identified. A summary of on-going research is presented in each area, and the potential roles of industry and government are considered. The most promising approaches for refrigeration technology fall into these categories: (1) improved vapor compressor cycles with alternate fluids, (2) Stirling cycle development and (3) advances in absorption technology. A summary of on-going research into advanced insulation, focused on vacuum – based insulation technology refrigeration is developed. Insulation applications considered include appliances, transport refrigeration, and buildings. Specific recommendations for a long-term R&D agenda are present. The potential benefits, research, general approach, and probability of success are addressed.

33086 (DOE/FTR–93014672) **Travel to Japan to participate in meeting on Advanced Solar Low-Energy Buildings: Foreign trip report, September 4–12, 1992.** Balcomb, J.D. National Renewable Energy Lab., Golden, CO (United States). 17 Sep 1992. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE93014672. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of the trip was to participate in an Experts Meeting of the Advanced Solar Low-Energy Buildings Task 13 of the International Energy Agency Solar Heating and Cooling Program. This was held at the Highland Hotel Sanso in Tazawa-ko, Akita Prefecture, Japan. The meeting included a visit to the Japanese advanced house, a meeting of the Simulation Support Group, and a tour of solar buildings in Akita. The meeting took up three days, September 7–9. All agenda items were covered. Prof Ken-Ichi Kimura of Japan was host and did a superb job of organization. Logistics were done by NEDO (New Energy and Industrial Technology Development Organization). Expert presentations were given by Japanese on: overview of industrialized housing in Japan,

energy as a measure of performance, and performance of a PV-operated air conditioner. Each country presented a status report and a brief report of their house design.

33087 (DOE/FTR–93018987) **Travel to Italy for participation in the First International Workshop on Indoor radon remedial action: Foreign trip report, June 26–September 30, 1993.** James, A.C. Pacific Northwest Lab., Richland, WA (United States). 6 Aug 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93018987. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document is a foreign travel report of a PNL scientist. The purpose of the trip to Rimini, Italy was to participate in the First International Workshop on Indoor Radon Remedial Action, and to present the invited keynote paper in the scientific session "Health Effects – Physical Factors."

33088 (LBL–34362) **The effect of simplifying the building description on the numerical modeling of its thermal performance.** Stetiu, C. Lawrence Berkeley Lab., CA (United States). Jul 1993. 98p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93019226. Source: OSTI; NTIS; GPO Dep.

A thermal building simulation program is a numerical model that calculates the response of the building envelopes to weather and human activity, simulates dynamic heating and cooling loads, and heating and cooling distribution systems, and models building equipment operation. The scope of the research is to supply the users of such programs with information about the dangers and benefits of simplifying the input to their models. The Introduction describes the advantages of modeling the heat transfer mechanisms in a building. The programs that perform this type of modeling have, however, limitations. The user is therefore often put in the situation of simplifying the floor plans of the building under study, but not being able to check the effects that this approximation introduces in the results of the simulation. Chapter 1 is a description of methods. It also introduces the floor plans for the office building under study and the "reasonable" floor plans simplifications. Chapter 2 presents DOE-2, the thermal building simulation program used in the sensitivity study. The evaluation of the accuracy of the DOE-2 program itself is also presented. Chapter 3 contains the sensitivity study. The complicated nature of the process of interpreting the temperature profile inside a space leads to the necessity of defining different building modes. The study compares the results from the model of the detailed building description with the results from the models of the same building having simplified floor plans. The conclusion is reached that a study of the effects of simplifying the floor plans of a building is important mainly for defining the cases in which this approximation is acceptable. Different results are obtained for different air conditioning/load regimes of the building. 9 refs., 24 figs.

33089 (NEI-DK–1258) **Development and testing of electric saucepan with power regulation facility.** Gydesen, A.; Maimann, D. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Fysisk Lab. 3. Dec 1992. 42p. (In Danish). Contract ENS-1223/90-0004. Order Number DE93516672. Source: OSTI; NTIS.

EFP-90.

The overall aim was to promote the development of low energy apparatus so that in the long-term this can contribute to the general reduction in the use of electric power which is the goal of Danish energy and environmental policies. The aim of the project was to develop a prototype of an electric saucepan and to investigate how much energy can be saved by using this in comparison to the use of an ordinary saucepan placed on a hotplate on an electric cooker. Another aim was to develop a design which will lead to the greatest reduction in electricity use, where electricity use can be regulated and with optimal conditions of heat dispersion on the base of the saucepan. The electric saucepan is defined as one where the heating element is located in direct contact with the base of the utensil. A 3 liter aluminium electric saucepan was investigated. The regulation system of the electric saucepan and the testing and comparisons of it and the saucepan to be used on a hotplate are described in detail in addition to energy saving potentials water boiling and food preparation conditions. It was found that much energy (30-40%) was saved when heating up water (most in relation to small volumes) in the electric saucepan, in comparison with the saucepan heated by a hotplate. When rice was cooked electricity saved was also greater than when the saucepan on the hotplate was used. It was found that 17 out of 19 consumers were satisfied with their electric saucepans and claimed that they are quicker in use and easy to regulate, although the regulating facility is unhandy. (AB) (16 refs.)

33090 (NEI-DK–1262) **Efficient and energy-saving lighting in offices.** Lysteknisk Selskab, Stenloese (Denmark). [1993]. 37p. (In Danish). Order Number DE93525252. Source: OSTI; NTIS.

The booklet, which is illustrated by a large number of coloured photographs, gives detailed information on lighting suitable for all types of rooms found in office buildings. In this connection further guidelines are offered on the quality of suitable lighting systems which are efficient, energy saving and attractive. A scheme for the registration of electricity consumption by office lighting is presented. This could provide the basis for decision making related to improvements of existing lighting facilities. A short glossary of related Danish terminology and a list of Danish consultant services with addresses and telephone numbers are given. (AB)

33091 (NYSERDA–93-6) **Analysis of fuel savings associated with fuel computers in multifamily buildings: Final report.** McNamara, M. (EME Group, New York, NY (US)); Anderson, J.; Huggins, E. New York State Energy Research and Development Authority, Albany, NY (United States); EME Group, New York, NY (United States). Jun 1993. 68p. Sponsored by New York State Energy Research and Development Authority, Albany, NY (United States). Source: OSTI; New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, NY 12223.

This research was undertaken to quantify the energy savings associated with the installation of a direct monitoring control system (DMC) on steam heating plants in multi-family buildings located in the New York City metropolitan area. The primary objective was to determine whether fuel consumption was lower in buildings employing a DMC relative to those using the more common indirect monitoring control system (IMC) and if so, to what extent. The analysis compares the fuel consumption of 442 buildings over 12 months. The type of control system installed in these buildings was either a Heat-Timer (identified as IMC equipment) or a computer-based unit (identified as DMC equipment). IMC provides control by running the boiler for longer or shorter periods depending on outdoor temperature. This system is termed indirect because there is no feedback from indoor (apartment) temperatures to the control. DMC provides control by sensing apartment temperatures. In a typical multifamily building, sensors are hard wired to between 5 and 10 apartments sensors. The annual savings and simple payback were computed for the DMC buildings by comparing annual fuel consumption among the building groupings. The comparison is based on mean BTUs per degree day consumed annually and normalized for building characteristics, such as, equipment maintenance and boiler steady state efficiency as well as weather conditions. The average annual energy consumption for the DMC buildings was 14.1 percent less than the annual energy consumption for the IMC buildings. This represents 3,826 gallons of No. 6 fuel oil or $2,295 at a price of $0.60 per gallon. A base DMC system costs from $8,400 to $10,000 installed depending on the number of sensors and complexity of the system. The standard IMC system costs from $2,000 to $3,000 installed. Based on this analysis the average simple payback is 2.9 or 4.0 years depending on either an upgrade from IMC to DMC (4.0 years) or a new installation (2.9) years.

33092 (ORNL/CON–367) **The technical viability of alternative blowing agents in polyisocyanurate roof insulation: A cooperative industry/government project.** Christian, J.E.; Courville, G.E.; Desjarlais, A.O.; Graves, R.S.; Linkous, R.L.; McElroy, D.L.; Weaver, F.J.; Wendt, R.L.; Yarbrough, D.W. Oak Ridge National Lab., TN (United States). Jun 1993. 103p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93018129. Source: OSTI; NTIS; GPO Dep.

This report is a summary of the cooperative industry/government program to establish the viability of alternative blowing agents to

chlorofluorocarbons (CFCs). The project was initiated in 1989 following two workshops that focused on needed research on thermal insulation blown with substitutes for CFC-11 and CFC-12. The project is directed by a steering committee of representatives of the sponsors and of Oak Ridge National Laboratory (ORNL). The purpose of the project is to determine if the performance of polyisocyanurate (PIR) roof insulation foam boards blown with alternate agents differs from the performance of boards blown with CFC-1. This report describes apparent thermal conductivity (k) results obtained from field and laboratory tests from 1989 to 1992 on a set of experimental PIR laminate boardstock produced to evaluate the viability of alternative hydrochlorofluorocarbons (HCFCs) as blowing agents. All boardstock was manufactured from similar formulations that were not optimized for thermal performance. Commercial broadstock made in the future may differ in performance from this set. The PIR boards were prepared with CFC-11, HCFC-123, HCFC-141b, and 50/50 and 65/35 blends of HCFC-123/HCFC-141b.

33093 (PNL–8725) **Energy baseline and energy efficiency resource opportunities for the Forest Products Laboratory, Madison, Wisconsin.** Mazzucchi, R.P. (SBW Consulting Co., Bellevue, WA (US)); Richman, E.E.; Parker, G.B. Pacific Northwest Lab., Richland, WA (United States). Aug 1993. 131p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93040200. Source: OSTI; NTIS; GPO Dep.

This report provides recommendations to improve the energy use efficiency at the Forest Products Laboratory in Madison, Wisconsin. The assessment focuses upon the four largest buildings and central heating plant at the facility comprising a total of approximately 287,000 square feet. The analysis is comprehensive in nature, intended primarily to determine what if any energy efficiency improvements are warranted based upon the potential for cost-effective energy savings. Because of this breadth, not all opportunities are developed in detail; however, baseline energy consumption data and energy savings concepts are described to provide a foundation for detailed investigation and project design where warranted.

33094 (PNL–8730-Vol.3) **Vandenberg Air Force Base integrated resource assessment: Volume 3, Resource assessment.** Daellenbach, K.K.; Dagle, J.E.; Dittmer, A.L.; Elliott, D.B.; Halverson, M.A.; Hickman, B.J.; Parker, G.B.; Richman, E.E.; Shankle, S.A. Pacific Northwest Lab., Richland, WA (United States). Jun 1993. 236p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93017941. Source: OSTI; NTIS; GPO Dep.

The US Air Force Space Command (SPACECOM) has tasked the Pacific Northwest Laboratory (PNL), as the lead laboratory supporting the US Department of Energy (DOE) Federal Energy Management Program (FEMP), to identify, evaluate, and assist in acquiring all cost-effective energy projects at Vandenberg Air Force Base (VAFB). This is part of a model program that PNL is designing to support energy-use decisions in the federal sector. This report provides the results of the fossil fuel and electric energy resource opportunity (ERO) assessments performed by PNL at the SPACECOM VAFB facility located approximately 50 miles northwest of Santa Barbara, California. It is a companion report to Volume 1, Executive Summary, and Volume 2, Baseline Detail. The results of the analysis of EROs are presented in ten common energy end-use categories (e.g., boilers and furnaces, service hot water, and building lighting). In addition, a case study of process loads at Space Launch Complex-4 (SLC-4) is included. A narrative description of each ERO is provided, including information on the installed cost, energy and dollar savings; impacts on operation and maintenance (O and M); and, when applicable, a discussion of energy supply and demand, energy security, and environmental issues. A description of the evaluation methodologies and technical and cost assumptions is also provided for each ERO. Summary tables present the cost-effectiveness of energy end-use equipment before and after the implementation of each ERO and present the results of the life-cycle cost (LCC) analysis indicating the net present value (NPV) and value index (VI) of each ERO. Finally, an appendix includes a summary of an economic analysis case study of the South Vandenberg Power Plant (SVPP) operating scenarios.

33095 (PNL–8756-Vol.2) **Patrick Air Force Base integrated resource assessment: Volume 2, Baseline detail.** Wahlstrom, R.R.; King, D.A.; Parker, S.A.; Sandusky, W.F. Pacific Northwest Lab., Richland, WA (United States). Aug 1993. 80p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93040348. Source: OSTI; NTIS; GPO Dep.

The US Air Force has tasked the Pacific Northwest Laboratory (PNL), in support of the US Department of Energy (DOE) Federal Energy Management Program (FEMP), to assess energy use at Patrick Air Force Base (AFB). The information obtained from this assessment will be used in identifying energy resource opportunities to reduce overall energy consumption on the base. The primary focus of this report is to assess the current baseline energy consumption at Patrick AFB. It is a comparison report to Volume 1, the Executive Summary, and Volume 3, the Resource Assessment. This assessment requires that information be obtained and characterized for buildings, utilities, energy sources, energy uses, and load profile information to be used to improve the characterization of energy use on the base. The characteristics of electricity, natural gas, and No. 2 fuel oil are analyzed for on-base facilities and housing. The assessment examines basic regional information used to determine energy-use intensity (EUI) values for Patrick AFB facilities by building, fuel type, and energy end use. It also provides a summary of electricity consumption from Florida Power and Light Company (FPL) metered data for 1985-1991. Load profile information obtained from FPL data is presented for the north and south substations for the four seasons of the year, including weekdays and weekends.

33096 (PNL–8771-Vol.2) **Fort Stewart integrated resource assessment: Volume 2, Baseline detail.** Keller, J.M.; Sullivan, G.P.; Wahlstrom, R.R.; Larson, L.L. Pacific Northwest Lab., Richland, WA (United States). Aug 1993. 76p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019881. Source: OSTI; NTIS; GPO Dep.

This report documents the assessment of baseline energy use at Fort Stewart, a US Army Forces Command facility located near Savannah, Georgia. This is a companion report to Volume 1, Executive Summary, and Volume 3, Integrated Resource Assessment. The US Army Forces Command (FORSCOM) tasked Pacific Northwest Laboratory (PNL) to identify, evaluate, and assist in acquiring all cost-effective energy projects at Fort Stewart. PNL, in support of the US Department of Energy (DOE) Federal Energy Management Program (FEMP), has designed a model program applicable to the federal sector for this purpose. The model program (1) identifies and evaluates all cost-effective energy projects; (2) develops a schedule at each installation for project acquisition considering project type, size, timing, and capital requirements, as well as energy and dollar savings; and (3) targets 100% of the financing required to implement energy efficiency projects. PNL applied this model program to Fort Stewart. The analysis examines the characteristics of electric, natural gas, oil, propane, and wood chip use for fiscal year (FY) 1990. The results include energy-use intensities for the facilities at Fort Stewart by building type, fuel type, and energy end use. A complete energy consumption reconciliation is presented that accounts for the distribution of all major energy uses and losses among buildings, utilities, and central systems.

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Refer also to citation(s) 33124, 33749, 34493

33097 (ADEME–91-01-DOC-1, pp. 93-114) **Air pollution caused by vehicles: the Paris area case.** Person, A. Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9111328–: Colloquium on biomass: an energy source for the quality of environment, Paris (France), 27-28 Nov 1991). In *Biomass: an energy source for the quality of environment.* 245p. Order Number DE94700004. Source: OSTI; NTIS (US Sales Only).

Air pollution in Paris is mainly due to vehicle traffic; in order to better understand the various types of pollution propagation (long distance, mean and close proximity pollutions), indicator selection and siting is studied: mean level pollution evolution, seasonal cycles, CO, CO2 and black fumes monitoring... Depending of the pollutant specificity, atmospheric pollution level may vary more or less with the traffic evolution during the day or the season. Air sampling conditions, site and indicator selection criteria are discussed.

33098 (ADEME–91-01-DOC-1, pp. 115-116) **Pollution: biofuels and conventional fuels.** Charlet, A. Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9111328–: Colloquium on biomass: an energy source for the quality of environment, Paris (France), 27-28 Nov 1991). In *Biomass: an energy source for the quality of environment.* 245p. Order Number DE94700004. Source: OSTI; NTIS (US Sales Only).

Pollutant compounds from vehicles are reviewed: CO, NOx and non-burned hydrocarbons (for all vehicles) and particles and fumes for diesel vehicles. Pollution can be reduced by biofuel utilization: less CO and NOx emission, modification of the non-burned hydrocarbons, doubling of the aldehydes. The anti-pollution regulations does not still take into account bio-fuels; modification of the regulations could enhance conversion to bio-fuels.

33099 (ADEME–91-01-DOC-1, pp. 117-122) **Effect of environmental constraints on the automobile evolution.** Hublin, M. Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9111328–: Colloquium on biomass: an energy source for the quality of environment, Paris (France), 27-28 Nov 1991). In *Biomass: an energy source for the quality of environment.* 245p. Order Number DE94700004. Source: OSTI; NTIS (US Sales Only).

The european standards concerning pollution and automobile vehicle emissions are reviewed: positive ignition engines, diesel engines (advantages and drawbacks, particle emission and NOx emission problems); the technical prospects for reducing the engine emissions are discussed: (exhaust gas recirculation, catalytic muffler, ...); requirements concerning fuel quality for engine cleanliness and emission reduction are assessed; advantages of bio-fuels are also addressed.

33100 (ADEME–91-01-DOC-1, pp. 235-245) **Comparison of eco-balance between di-ester and gas oil: an example for an european approach of effects on environment.** Heintz, B. Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9111328–: Colloquium on biomass: an energy source for the quality of environment, Paris (France), 27-28 Nov 1991). In *Biomass: an energy source for the quality of environment.* 245p. Order Number DE94700004. Source: OSTI; NTIS (US Sales Only).

The aim of this study is to compare the effects on environment for the utilization of di-ester and gas oil fuel in a diesel vehicle: environmental balance of the colza ester production and utilization system, simulation of the effects on environment of two colza cultivation scenarios (from a fallow or from a substitution to food colza), evaluation of aqueous effluents, solid wastes and air pollution emissions.

33101 (NREL/TP–421-5264) **Data collection plan for Phase 2 Alternative Fuels Bus Data Collection Program: Final report.** Krenelka, T. (Battelle Columbus Labs., OH (United States)). National Renewable Energy Lab., Golden, CO (United States); Battelle Columbus Labs., OH (United States). Jul 1993. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE93010047. Source: OSTI; NTIS; GPO Dep.

This document constitutes the plan for collecting and reporting data associated with a special set of transit bus demonstrations to be conducted under the Urban Bus Program of the Alternative Motor Fuels Act (AMFA) of 1988. This program, called the Phase 2 Bus Data Collection Program, serves as an adjunct to the Phase I Bus Data Collection Program, collecting detailed data on just a few buses to augment and enhance the Phase 1 data in fulfilling the urban bus requirements of AMFA. Demonstrations will be conducted at a few transit system locations throughout the US and will use alternative fuels and associated technologies to reduce undesirable transit bus exhaust emissions. Several organizations will be involved in the data collection; NREL will manage the program, analyze and store vehicle data, and make these data available through the Alternative Fuels Data Center. This information will enable transit agencies, equipment manufacturers, fuel suppliers, and government policy makers to make informed decisions about buying and using alternative fuels.

33102 (ORNL/CON–359) **The Oak Ridge National Laboratory automobile heat pump model: User's guide.** Kyle, D.M. Oak Ridge National Lab., TN (United States). May 1993. 92p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93018727. Source: OSTI; NTIS; GPO Dep.

A computer program has been developed to predict the steady-state performance of vapor compression automobile air conditioners and heat pumps. The code is based on the residential heat pump model developed at Oak Ridge National Laboratory. Most calculations are based on fundamental physical principles, in conjunction with generalized correlations available in the research literature. Automobile air conditioning components that can be specified as inputs to the program include open and hermetic compressors; finned tube condensers; finned tube and plate-fin style evaporators; thermal expansion valve, capillary tube and short tube expansion devices; refrigerant mass; evaporator pressure regulator; and all interconnecting tubing. The program can be used with a variety of refrigerants, including R134a. Methodologies are discussed for using the model as a tool for designing all new systems or, alternatively, as a tool for simulating a known system for a variety of operating conditions.

33103 (SAND–92-2801C) **The potential of intelligent vehicle highway systems for enhanced traveler security.** Caskey, D.L. Sandia National Labs., Albuquerque, NM (United States). [1992]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9310132–1: 1993 Institute of Electrical and Electronics Engineers (IEEE) international Carnahan conference on security technology, Ottawa (Canada), 13-17 Oct 1993). Order Number DE93017889. Source: OSTI; NTIS; GPO Dep.

The Intelligent Vehicle Highway System (IVHS) program that was mandated by the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) presents a number of opportunities and challenges. While the program primarily is intended to address the problem of traffic congestion, the technologies it will require could also be used to enhance the safety and security of the traveling public. Public transit systems offer the most likely near-term opportunities both for IVHS-type technologies, and for new security measures to be applied. This paper will address some of the possible security functions that could be applied to transit systems by utilizing the availability of Automatic Vehicle Location systems (AVL), broadband digital communication systems, and other IVHS functions.

3203 Industrial and Agricultural Processes

Refer also to citation(s) 32268, 32487, 32546, 32661, 32674, 32766, 32968, 33021, 33077, 33081, 33084, 33408, 33783

33104 (CONF-9305245–1) **Waste treatment for removed protective coatings.** Gat, U. (Oak Ridge National Lab., TN (United States)); Crosley, S.M.; Gay, R.L. Oak Ridge National Lab., TN (United States). [1993]. 6p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. From Department of Defense/Industry Advanced Coatings Removal conference; Phoenix, AZ (United States); 25-27 May 1993. Order Number DE93017763. Source: OSTI; NTIS; GPO Dep.

A molten salt oxidation process is proposed for treatment of removed protective coatings along with the media used for removal. The treatment chemically reduces the waste, leaving any metals associated with the coating as a residue in the salt treatment media. The residue and the salt can be further treated for recycle of the metals, thus all but eliminating metal disposal as a waste problem. The process is expected to be simple and may be integrated

into the coatings removal operations on location. Therefore, waste shipment and handling can be significantly reduced, and, as a secondary benefit, other waste can be treated in the same unit.

33105 (DOE/CE/15464–T6) **Tip stabilizer for a chain saw: Final report.** Morabit, V.D. Utilitip, Inc., Rock Hill, SC (United States). 10 Sep 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-91CE15464. Order Number DE93041086. Source: OSTI; NTIS; GPO Dep.

Prior to receiving the grant, Utilitip was faced with an idea that truly worked, however only a very limited line of component parts would fit various types of chain saws on the market. It also suffered from a severe problem when engaged in the ground of soil penetrating the saw chain area, thus eliminating one of the major benefits of keeping the chain sharp. Consequently, the grant funding was directed towards extending the tooling capabilities to produce parts for a much wider variety of chain saws that are on the market, and further by developing an effective flexible soil shield to prevent abrasive soil entry into the saw chain. Utilitip was able to complete a full set of design for a wide variety of large and small chain saws. This incorporated a design and fabrication of a small Utilitip, as well as a small anti-kickback device. In addition, tooling was also further developed for the large Utilitip and the large anti-kickback device. Accordingly, multiple tools are available for all combinations, as well as back-up provisions. Utilitip, Inc. invented a special, flexible attachment to be glued and/or molded to the tip guard. The soil shield prevents abrasive soil from coming into the chain area. In addition, it allows a flexible arrangement to allow the chain saw to be released from brush without binding. Otherwise, a larger, rigid soil shield would hold or restrict the saw in heavy brush. The rubber shield will flex out of the say and reduce, if not eliminate, this harmful binding.

33106 (DOE/OSTI–11633/4) **Office of Industrial Technologies research in progress.** USDOE Assistant Secretary of Energy Efficiency and Renewable Energy, Washington, DC (United States). Office of Industrial Technologies; USDOE Office of Scientific and Technical Information, Oak Ridge, TN (United States). May 1993. 71p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93011440. Source: OSTI; NTIS; GPO Dep.

The US Department of Energy (DOE) Office of Industrial Technologies (OIT) conducts research and development activities which focus on improving energy efficiency and providing for fuel flexibility within US industry in the area of industrial conservation. The mission of OIT is to increase the utilization of existing energy-efficient equipment and to find and promote new, cost-effective ways for industrial facilities to improve their energy efficiency and minimize waste products. To ensure advancement of the technological leadership of the United States and to improve the competitiveness of American industrial products in world markets, OIT works closely with industrial partners, the staffs of the national laboratories, and universities to identify research and development needs and to solve technological challenges. This report contains summaries of the currently active projects supported by the Office of Industrial Technologies.

33107 (DOE/PC/92521–T49) **Utilization of Illinois coal gasification slags for production of ultra-lightweight aggregates: [Quarterly] technical report, March 1–May 31, 1993.** Choudhry, V. (Praxis Engineers, Inc., Milpitas, CA (United States)); Zimmerle, T. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1993]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC22-92PC92521. Order Number DE93019799. Source: OSTI; NTIS; GPO Dep.

This research is aimed at testing and developing the expansion potential of gasification solid residues (slag) to manufacture ultra-lightweight aggregates (ULWA). Conventional ULWAs are manufactured by pyroprocessing of perlite or vermiculite ores and have unit weights in the range of 5–15 lb/ft3. These materials are sold for approximately $200/ton (or $1.00/ft3) and have numerous applications including loose fill insulation, insulating concrete, precast products, filtration media, and agricultural applications. In a previous project, Praxis Engineers demonstrated that lightweight aggregates (LWA) with unit weights of 25–55 lb/ft3 can be produced from Illinois coal slags and used as substitutes for conventional LWAs. In this program, tests are being undertaken in a pilot-scale vertical shaft furnace to identify operating conditions for the expansion of Illinois slags such that the product can be substituted for ULWA. Upon completion of testing, a large batch of expanded slag will be produced for evaluation in various applications, both in this phase and in subsequent Phase II testing. During the initial pilot plant runs using two Illinois slags, expanded products with unit weights of 12.5–26.5 and 20–52 lb/ft3, respectively, were produced. Efforts are under way to generate products with lower unit weights.

33108 (NEI-DK–1234) **Decentral cogeneration of heat and electricity: Note on status.** Energistyrelsen, Copenhagen (Denmark). May 1991. 20p. (In Danish). Order Number DE93516636. Source: OSTI; NTIS.

The development of decentral plants cogenerating electric power and heat is progressing in Denmark. The political aim is that, by 1995, the total capacity for electric power related to these plants should be 450 MW. All the plants should be fired with domestic fuels such as natural gas, straw, wood chips, wastes and methane from the conversion of biomass. Of the 34 authorized plants (total capacity 291 MW), with an additional small number of very small ones (0.5 MW in all), 12-15 have been in operation for more than half a year. Short descriptions of the authorized cogeneration plants in Denmark are presented, giving concise information on components and capacity. Plans for future development are briefly explained. Some experiences gained related to design and operation are described, and actual investments are illustrated with the help of tables. (AB)

33109 (NEI-DK–1269) **Training of energy managers for energy conservation in Polish industry: Final report.** Danish Energy Analysis, Ballerup (Denmark). Oct 1992. 45p. Contract IMOe-292;Contract ENS-211/73-0004. Order Number DE93525267. Source: OSTI; NTIS.

In cooperation with the Polish corporation, the Polish Foundation for Energy Efficiency in Katowice, Danish Energy Analysis has developed and carried out a pilot 3-day course in energy management intended for Polish industry. Before the course 3 Polish engineers visited a number of Danish companies who informed the engineers how they worked with energy management. Danish teachers covered the subjects of energy management, financial valuations and electricity savings. The Polish teachers covered mainly the more technical subjects. There were 23 participants from the steel industry, sugar industry and refineries. They expressed their satisfaction with the course and the comprehensive course material which was translated into Polish. Four months after the course AKF (The Institute of Local Government Studies, Denmark) found that the participants had been able to utilize the knowledge they had received. Many of them were now introducing energy management in their companies. Both FEWE and Danish Energy Analysis find there is a great need of more courses for the Polish industry. (AB)

33110 (NEI-NO–354) **Modeling and control of submerged-arc ferrosilicon furnaces.** Valderhaug, Aa.M. Trondheim Univ. (Norway). Norges Tekniske Hoegskole. Nov 1992. 375p. Order Number DE93516708. Source: OSTI; NTIS.

The occurrence of electric arcs plays an important role in a ferrosilicon furnace. As the arcs are the main source of electric power generation in the furnace, changes in the arcing conditions will affect the total process conditions significantly. In addition, using electric measurements the effects of electric arcing may indirectly give important information about inner process variables. Based on these facts, the thesis gives a comprehensive review of arcing theory related to the arcs present in submerged-arc furnaces. Focus is placed on the properties of such arcs and their influence on the conditions in the cavities in a ferrosilicon furnace. Attention is also given the modeling aspects of electric arcs. Different model descriptions of direct current (DC) arcs are reviewed, and three-dimensional analytic models and channel models are discussed. A further subject is dynamic models of alternating current (AC) arcs. Empirical dynamic models of AC arcs are briefly described, while dynamic AC arc models based on arc channel modeling, are considered in more detail. This part of the thesis concludes with the recommendation to use dynamic AC arc channel models to describe the arcing in submerged-arc ferrosilicon furnaces. The study of the electrical conditions in a ferrosilicon furnace has verified the

importance of a satisfactory electrical control system. It can be further concluded that significant information about inner process variables is accessible by the use of a model-based estimator operating on electrical measurements. The chemical reactions in the ferrosilicon process are treated and a stoichiometric model is described. Important terms related to the process are defined, and models of possible reaction patterns are discussed. This discussion concludes with a recommendation about how the process variables should be used in the metallurgical control of the furnace. 141 refs., 123 figs., 12 tabs.

33111 (PNL–8739) **Low-temperature catalytic gasification of wet industrial wastes: FY 1991–1992 interim report.** Elliott, D.C.; Neuenschwander, G.G.; Hart, T.R.; Phelps, M.R.; Sealock, L.J. Jr. Pacific Northwest Lab., Richland, WA (United States). Jul 1993. 115p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93018494. Source: OSTI; NTIS; GPO Dep.

A catalytic gasification system operating in a pressurized water environment has been developed and refined at Pacific Northwest Laboratory (PNL) for over 12 years. Initial experiments were aimed at developing kinetics information for steam gasification of biomass in the presence of catalysts. The combined use of alkali and metal catalysts was reported for gasification of biomass and its components at low temperatures (350°C to 450°C). From the fundamental research evolved the concept of a pressurized, catalytic gasification system for converting wet biomass feedstocks to fuel gas. Extensive batch reactor testing and limited continuous reactor system (CRS) testing were undertaken in the development of this system under sponsorship of the US Department of Energy. A wide range of biomass feedstocks were tested, and the importance of the nickel metal catalyst was identified. Specific use of this process for treating food processing wastes was also studied. The concept application was further expanded to encompass cleanup of hazardous wastewater streams, and results were reported for batch reactor tests and continuous reactor tests. Ongoing work at PNL focuses on refining the catalyst and scaling the system to long-term industrial needs. The process is licensed as the Thermochemical Environmental Energy System (TEES®) to Onsite*Ofsite, Inc., of Duarte, California. This report is a follow-on to the 1989–90 interim report [Elliott et al. 1991], which reviewed the results of the studies conducted with a fixed-bed, continuous-feed, tubular reactor. The discussion here provides an overview of experiments on the wide range of potential feedstock materials conducted in a batch reactor; development of new catalyst materials; and tests performed in continuous-flow reactors at three scales. The appendices contain the history and background of the process development, as well as more detailed descriptions and results of the recent studies.

33112 (SAND–93-1672) **Manufacturing technology.** Leonard, J.A.; Floyd, H.L.; Goetsch, B.; Doran, L. (eds.). Sandia National Labs., Albuquerque, NM (United States). Aug 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93019580. Source: OSTI; NTIS; GPO Dep.

This bulletin depicts current research on manufacturing technology at Sandia laboratories. An automated, adaptive process removes grit overspray from jet engine turbine blades. Advanced electronic ceramics are chemically prepared from solution for use in high- voltage varistors. Selective laser sintering automates wax casting pattern fabrication. Numerical modeling improves performance of photoresist stripper (simulation on Cray supercomputer reveals path to uniform plasma). And mathematical models help make dream of low- cost ceramic composites come true.

3206 Municipalities and Community Systems

Refer also to citation(s) 32672, 33067, 33095, 33096, 33799

33113 (DOE/FTR–93017328) **Travel to Scotland to review IEA Task VII on methods for conversion of biomass feedstocks and plan new Tasks XI on converting municipal solid waste to energy: Foreign trip report, March 31–April 9, 1992.** Chum, H.L. National Renewable Energy Lab., Golden, CO (United States). 12 Apr 1992. 93p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE93017328. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report describes discussions held in Scotland at an IEA seminar pertaining to biomass and municipal solid wastes conversion to energy.

33114 (LA-SUB–93-237-Vol.2) **TA-16 steam plant evaluation: Final report–Volume II, appendix.** Los Alamos National Lab., NM (United States); Stone and Webster Engineering Corp., Denver, CO (United States). Nov 1992. 296p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93018281. Source: OSTI; NTIS; GPO Dep.

This Volume II contains the appendices to the final report on the TA-16 Steam Plant. The contents of the appendices include complete spare part supplier information; complete replacement burner information; complete economizer information; complete diesel generator information; complete motor control center information; complete package boiler information; and project calculations. The study was conducted to determine the feasibility of upgrading the steam heating plant at the Los Alamos National Laboratory. The heating plant is used for building and process heating.

33115 (LUTEDX-TEIE–5069-1-49) **Characterization of "Energy Islands": Small-scale LPG based cogeneration with energy storage for supply to a small region - an Energy Island.** Rasmusson, N.; Qvistbaeck, P. Lund Univ. (Sweden). Dept. of Industrial Electrical Engineering and Automation. Sep 1992. 54p. (In Swedish). Order Number DE93516734. Source: OSTI; NTIS.

Examination paper.

This report describes small-scale combined heat and power systems. A local power plant, supplying a limited area of consumers (private or industry) - here called an "energy island" - is compared with traditional designs. The plant consists of an Otto cycle engine and a thermal energy storage. The possibility of using battery energy storage is also described. Future applications of energy storage are presented in different scenarios. (17 refs., 33 figs., 8 tabs.)

33116 (UCRL-ID–113954) **Ground-penetrating imaging radar development for bridge deck and road bed inspection.** Warhus, J.P.; Mast, J.E.; Nelson, S.D.; Johansson, E.M. Lawrence Livermore National Lab., CA (United States). May 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93018498. Source: OSTI; NTIS; GPO Dep.

Ground-penetrating imaging radar (GPIR) is proposed for large-area inspection of concrete and concrete/asphalt composite bridge decks and roadways. This technique combines ground-penetrating radar (GPR) with unique image reconstruction algorithms developed for identification and characterization of subsurface flaws and structural features. New data acquisition hardware and image reconstruction techniques, under development at LLNL, offer the possibility for reliable and efficient, high-resolution subsurface imaging through the use of improved ultra-wideband transmitters, antennas, and arrays, and enhanced image- and signal-processing software. A field test of a limited-capability prototype system is planned for FY-93, as is completion of a conceptual design for a practical inspection system. A follow-on program for FY-94 would focus on development and demonstration of an advanced bridge inspection system prototype based on the conceptual design completed during FY-93.

3209 Education and Public Relations

33117 (ANL/EAIS/TM–101) **Summary evaluation of the video, "Transportation of radioactive and hazardous materials: Safety for all concerned".** Monroe, M.C.; Young, C.F. Argonne National Lab., IL (United States). Jul 1993. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93019867. Source: OSTI; NTIS; GPO Dep.

Outreach materials are often developed and distributed without evaluation of their effectiveness. This report provides a glimpse of the effectiveness of one of the US Department of Energy's videos on transportation of radioactive and hazardous materials. Data

from a survey developed by Modern Talking Picture Service, Inc. are summarized. This survey was sent to recipients of the video at three to six weeks after they had received and viewed the video. The response rate is unknown; hence, the results suggest the range of perspectives on the video, rather than the representativeness of those perspectives. The results are also limited by incomplete responses to the survey. Most respondents were middle school and high school teachers who resided throughout the country. Respondents used the video in nearly all school subjects. Most respondents indicated that the video was fairly good and appreciated the factual information, although some saw it as propaganda. Respondents indicated that they would like additional information on hazardous wastes, nuclear power, and transportation. The test crashes were mentioned as a highlight of the video. Recommendations for revising the video and survey are included.

33118 (ETDE-IT–93-200) **ENEA Activities and experience in the diffusion of energy efficiency.** Mebane, W. (ENEA, Casaccia (Italy). Area Energia e Innovazione); Funaro, G. 1992. 22p. (CONF-9210372–4: Workshop on the rational use of energy, Budapest (Hungary), 27-29 Oct 1992). Order Number DE93522937. Source: OSTI; NTIS (US Sales Only).

The evolution in the strategy of the promotion of energy efficiency by ENEA (Italian Agency for Energy, New Technologies and the Environment) is illustrated; emphasizing the need for new instruments in the face of the evolving energy and economic situation. In the updated strategy, new methods of financing, of reaching dispersed energy users in the residential and service sectors, of integrating technical norms with new product development, and of keeping energy professionals rapidly informed are stressed. This implies that the traditional instruments of information, training and diagnosis will be continued but within the new financial and normative framework. Examples of on-going projects and the results of 1991 are summarized.

33119 (LA-SUB–93-239) **Armed forces career exploration for high school students in the fields of engineering and science: Final report.** Los Alamos National Lab., NM (United States); Morgan State Univ., Baltimore, MD (United States). School of Engineering. 1993. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93018283. Source: OSTI; NTIS; GPO Dep.

Morgan State University's School of Engineering conducted its third annual Armed Forces Career Exploration program for high school students in the fields of engineering and science. The four week program was jointly sponsored by the US Army Laboratory Command (Ballistics Research Laboratory and Human Engineering Laboratory) and US Department of Energy (Los Alamos National Laboratory). The environment in a predominantly urban school system is such that a significant number of very capable students reach the eleventh grade without plans for the future. These students as a result of teacher influence have taken lower level math and science courses and we feel by participating in this program will see reasons for pursuing higher level math and science courses their last two years in high school. Inasmuch as intervention programs have not yet significantly affected the profile of these schools this pool of students represents an opportunity to make an early impact on the number of students that enter college intending to major in math, science or engineering. This report presents the program that provided selected students with pre-engineering and science enrichment experiences designed to enhance their understanding of engineering, increase their awareness of career opportunities in science and engineering, advance their readiness to enter temporary job situation, and foster the development of self-confidence in their individual capabilities.

33 ADVANCED PROPULSION SYSTEMS

Refer also to citation(s) 33012, 33236

3301 Internal Combustion Engines

Refer also to citation(s) 32749, 33106, 33125

33120 (NEI-DK–1246) **Non-linear regulation of petrol motors.** Eksamensprojekt - IMSOR, 30/92. Poulsen, B. Technical Univ. of Denmark, Lyngby (Denmark). Inst. of Mathematical and Operations Research; Danmarks Tekniske Hoejskole, Lyngby (Denmark). Servolaboratoriet. 1992. 179p. (In Danish). Order Number DE93516648. Source: OSTI; NTIS.

In this project, adaptive control has been examined, in order to optimize the indicated efficiency of a spark ignition engine. The controllers that have been developed are extremum controllers and the variable in control is the spark advance angle. Several design models of the efficiency have been examined. From these models, is achieved control of the spark advance angle, that is similar to conventional control, that is dependency on the crank shaft speed and manifold pressure. In addition to linear models, models that are nonlinear in parameters have ben examined in order to reduce the number of parameters. Control has been made under the assumption that the efficiency is measurable and also based on measurement of the crank shaft speed. Also the method of ortnogonal polynomials has got a brief examination. (au) (14 refs.)

33121 (NEI-NO–353) **Ignition and flame growth in lean gas-air mixtures: An experimental study with a schlieren system.** Ask, T.Oe. Trondheim Univ. (Norway). Norges Tekniske Hoegskole. Nov 1992. 231p. Order Number DE93516707. Source: OSTI; NTIS.

The ignition and combustion is very important for the performance of an internal combustion engine. In spark ignited engines the combustion process is dependant on precise timing of the ignition and a fast flame propagation. Spark ignited lean-burn engines fueled with natural gas or liquefied petroleum gas, has demonstrated high efficiency combined with very low emission of harmful combustion products. Very lean mixtures in gas engines has the potential of reducing pollution even further, but ignition of very lean mixtures remains a challenge. This thesis presents results from an experimental investigation of the initial flame growth in lean mixtures in general, and the effect of adding small amount of ethylene and hydrogene in lean mixtures of natural gas and air. The thesis includes a survey of measuring techniques used in earlier experimental work with emphasis on a schlieren system developed for visualization of the initial flame growth. This schlieren system offers several advantages compared to the traditional schlieren systems, and is capable of quantitative measurements of flame zone thickness and temperature profile in a laminar flame front. The ignition and initial flame growth of lean mixtures have been studied both in a combustion bomb and in a specially designed research engine, both fitted with quartz windows for observation of the initial flame growth. The most important findings in this experimental work are; The ignition properties of methane, ethane and propane are very different and strongly dependant on both quantities which are investigated, i.e. pressure and air-fuel equivalence ratio λ. The initial flame growth is characterised by a simple phenomenological model. Addition of small amounts of ethylene and hydrogen gives a considerable improvement of the ignition properties of lean mixtures of both natural gas and methane in air. 89 refs., 121 figs., 14 tabs.

3303 Electric-Powered Systems

33122 (ENEA-RTI-STUDI-ENE–92-04) **Electric automobiles: Technology and marketing assessments.** Laner, G.M. (ENEA, Rome (Italy). Direzione Studi). Dec 1992. 78p. (In Italian). (RTI/STUDI-ENE–92-04). Order Number DE93522966. Source: OSTI; NTIS (US Sales Only).

Over a hundred years ago, the first electric-powered road vehicle (EPRV) was technologically superior and faster than any other means of locomotion. After only a couple of decades, however, the EPRV was surpassed in performance and economy by the internal combustion engine, and interest in this type of road vehicle eventually died. Now, in response to the public's growing awareness concerning environmental quality and the need for urban air pollution abatement, car manufacturers are again turning their attention to the EPRV. The fundamental problem yet to be resolved however, concerning EPRV practicality, is how to conveniently store the energy required for engine and auxiliary systems operation. Focussing on the state-of-the-art in the design of light-weight, compact-sized, high performance electric batteries, this paper assesses the current overall performance capabilities of a variety of

EPRV models proposed by world leading car manufacturers. Comparisons are made with the performance capabilities of conventional cars. The paper suggests that greater incentives be established by governments actively engaged in environmental protection to promote industrial led research efforts aimed at the development of reliable, high performance batteries designed to meet the specific requirements of the EPRV.

33123 (LUTEDX-TEIE–5070-1-106) **Which electric traction system is best suited for electric cars: A simulation computer code is built to make a comparative study of four different electric traction systems for electric cars.** Andersson, Sven. Lund Univ. (Sweden). Dept. of Industrial Electrical Engineering and Automation. Nov 1992. 106p. (In Swedish). Order Number DE93516735. Source: OSTI; NTIS.

Examination paper.

Electric vehicles (EV) will probably be an important part of future environment friendly and efficient transport systems. The reason for this is our problem with pollution and noise that existing cars cause in our cities today. Therefore it is important to increase our knowledge about electrical vehicles in general and electrical drive systems for EV in particular. This report constitutes a link in this striving. A simulation program has been developed for comparison of four different electrical drive systems for EV's; direct current machine (DC), induction machine (AM), electrically magnetized synchronous machine (EMSM) and the permanently magnetized synchronous machine (PMSM). The concept electrical drive system includes both converter and motor. The comparison is not only limited to the electrical drive system, but also includes the transmission. In order to get realistic results of reachable distance and energy consumption it is necessary to take into account the battery characteristics as well as the air and rolling friction of the car. The comparison between the four systems is performed by simulations of a standardized driving cycle, Federal Urban Driving Cycle (FUDS) and constant speed respectively, to get each system's driving distance and energy consumption. The comparison does not take into account economical aspects such as production costs and economical lifetime. (14 refs., 22 figs.)

3304 Hybrid Systems

33124 (ANL/ES/CP–80046) **Analysis of a diesel-electric hybrid urban bus system.** Marr, W.W. (Argonne National Lab., IL (United States)); Sekar, R.R.; Ahlheim, M.C. Argonne National Lab., IL (United States); Regional Transportation Authority, Chicago, IL (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States); Department of Transportation, Washington, DC (United States). DOE Contract W-31109-ENG-38. Contract 85766. (CONF-9308143–4: 1993 Society of Automotive Engineers (SAE) future transportation technology conference, San Antonio, TX (United States), 9-12 Aug 1993). Order Number DE93019514. Source: OSTI; NTIS; GPO Dep.

A hybrid bus powered by a diesel engine and a battery pack has been analyzed over an idealized bus-driving cycle in Chicago. Three hybrid configurations, two parallel and one series, have been evaluated. The results indicate that the fuel economy of a hybrid bus, taking into account the regenerative braking, is comparable with that of a conventional diesel bus. Life-cycle costs are slightly higher because of the added weight and cost of the battery.

3307 Emission Control

Refer also to citation(s) 32673, 33127

33125 (ETDE-IT–93-197) **On-board diagnosis of emission control system malfunctions in electronically controlled spark ignition engines.** Azzoni, P.M. (ENEA, Bologna (Italy)); Rizzoni, G.; Minelli, G. 1993. 12p. (CONF-9304194–1: Tooldiag '93 International conference on fault diagnosis, Toulouse (France), 5-7 Apr 1993). Order Number DE93522935. Source: OSTI; NTIS (US Sales Only).

This paper discusses simulation and experimental results of a study aimed at diagnosing faults associated with an automotive engine exhaust emissions control system. Parity space methods are applied to a model of the engine intake, fueling, combustion and exhaust dynamics to diagnose faults in sensors and actuators used by the exhaust emissions control system. The results indicate that a mix of linear dynamic and nonlinear static models permit the design of an effective diagnostic strategy.

3308 Alternative Fuels

Refer also to citation(s) 33041, 33101

33126 (NREL/TP–421-5462) **Evaluation of aftermarket LPG conversion kits in light-duty vehicle applications: Final report.** Bass, E.A. (Southwest Research Inst., San Antonio, TX (US)). National Renewable Energy Lab., Golden, CO (United States); Southwest Research Inst., San Antonio, TX (United States). Jun 1993. 155p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE93010035. Source: OSTI; NTIS; GPO Dep.

SwRI was contracted by NREL to evaluate three LPG conversion kits on a Chevrolet Lumina. The objective of the project was to measure the Federal Test Procedure (FTP) emissions and fuel economy of these kits, and compare their performance to gasoline-fueled operation and to each other. Varying LPG fuel blends allowed a preliminary look at the potential for fuel system disturbance. The project required kit installation and adjustment according to manufacturer's instructions. A limited amount of trouble diagnosis was also performed on the fuel systems. A simultaneous contract from the Texas Railroad Commission, in cooperation with NREL, provided funds for additional testing with market fuels (HD5 propane and industry average gasoline) and hydrocarbon (HC) emissions speciation to determine the ozone-forming potential of LPG HC emissions. This report documents the procurement, installation, and testing of these LPG conversion kits.

33127 (NYSERDA–93-10) **Methanol fuel vehicle demonstration: Exhaust emission testing: Final report.** Hyde, J.D. (New York State Dept. of Environmental Conservation, Albany, NY (US). Automotive Emissions Lab.). New York State Energy Research and Development Authority, Albany, NY (United States); New York State Dept. of Environmental Conservation, Albany, NY (United States). Automotive Emissions Lab. Jul 1993. 35p. Sponsored by New York State Energy Research and Development Authority, Albany, NY (United States). Source: OSTI; New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, NY 12223.

Ford Motor Company converted four stock 1986 Ford Crown Victoria sedans to methanol flexible fuel vehicles (FFVs). During 143,108 operational miles from 1987 to 1990, the FFVs underwent more than 300 dynamometer driving tests to measure exhaust emissions, catalytic activity, fuel economy, acceleration, and driveability with gasoline and methanol blend fuels. Dynamometer driving tests included the Federal Test Procedure (FTP), the Highway Fuel Economy Test, and the New York City Cycle. Exhaust emission measurements included carbon dioxide, carbon monoxide (CO), nitrogen oxides (NO_x), non- oxygenated hydrocarbons, organic material hydrocarbon equivalent (OMHCE), formaldehyde, and methanol. Catalytic activity was based on exhaust emissions data from active and inactive catalysts. OMHCE, CO, and NO_x were usually lower with M85 (85% methanol, 15% gasoline) than with gasoline for both active and inactive catalysts when initial engine and catalyst temperatures were at or near normal operating temperatures. CO was higher with M85 than with gasoline when initial engine and catalyst temperatures were at or near ambient temperature. Formaldehyde and methanol were higher with M85. Active catalyst FTP OMHCE, CO, and NO_x increased as vehicle mileage increased, but increased less with M85 than with gasoline. Energy based fuel economy remained almost constant with changes in fuel composition and vehicle mileage.

35 ARMS CONTROL

Refer also to citation(s) 32611, 33742

3501 Policy, Negotiations, and Legislation

33128 (BNL–48581) **Open Skies: Facilitating the many dimensions of transparency.** Allentuck, J. Brookhaven National Lab., Upton, NY (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-930749–30: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93018672. Source: OSTI; NTIS; GPO Dep.

The Treaty on Open Skies (Open Skies) was signed on 24 March 1992 by 23 European nations in addition to the United States and Canada. Unlike other arms control treaties which prohibit specific weapons or weapon systems, Open Skies is intended to provide, in the words of its preamble, means "to facilitate the monitoring of compliance with existing or future arms control agreements." In addition, its objectives include the "improvement of openness and transparency for conflict prevention and crises management in the framework of the Conference on Security and Cooperation in Europe and in other relevant international institutions." The preamble also alludes to the possible extension of the Open Skies regime into additional (non-arms control) fields, such as environmental protection. Not mentioned is an objective which the treaty would appear to strive to attain: to equalize to some degree the ability of nations to obtain intelligence deemed essential to their national security. This is in fact the case since it provides such means to signatories which otherwise do not have direct access to advanced information gathering technology. "Open Skies" also contributes to monitoring or treaty verification by providing an instrument for cuing further investigation of information which might indicate impending treaty violation. Thus, while appearing unfocussed from a monitoring or treaty verification point of view, Open Skies represents substantial progress toward facilitating transparency.

33129 (LA–12592-MS) **Why the Gulf War still matters: Foreign perspectives on the war and the future of international security: Report No. 16.** Garrity, P.J. Los Alamos National Lab., NM (United States). Jul 1993. 118p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93019095. Source: OSTI; NTIS; GPO Dep.

This report summarizes the main findings of a Center for National Security Studies (CNSS) project that examined how a number of nations other than the United States have reacted to the course and outcome of the Persian Gulf War of 1991. The project was built around studies of key countries on which the Gulf War might reasonably be expected to have had a significant impact: Argentina, the ASEAN states, Brazil, China, Cuba, Egypt, France, Germany, India, Iran, Iraq, Israel, Italy, Japan, Jordan, Libya, North Korea, Russia, Saudi Arabia, South Korea, Spain, Syria, Taiwan, the United Kingdom, Vietnam, and the states of the former Yugoslavia. These country studies were written by well-recognized independent experts following a common set of guidelines provided by CNSS. When the country studies were completed, they were reviewed and supplemented through a series of peer assessments and workshops. The report represents a synthesis of material generated through this process, and is intended to stimulate thought and further analysis on the critical topics discussed herein.

33130 (UCRL-JC–113936) **Preparation for the Nuclear Non-Proliferation Treaty Extension Conference in 1995: Workshop summary.** Chrzanowski, P.L. Lawrence Livermore National Lab., CA (United States). 7 May 1993. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9302140–Summ.: Extension of the treaty on non-proliferation of nuclear weapons: issues for 1995, Cambridge, MA (United States), 11-12 Feb 1993). Order Number DE93018068. Source: OSTI; NTIS; INIS; GPO Dep.

About 30 specialists in non-proliferation participated in a workshop to explore ideas for US Government preparatory steps leading to the 1995 Nuclear Non-Proliferation Treaty (NPT) Extension Conference. To that end, workshop sessions were devoted to reviewing the lessons learned from previous Review Conferences, discussing the threats to the non-proliferation regime together with ways of preserving and strengthening it, and examining the management of international nuclear commerce. A fundamental premise shared by workshop participants was that extension of the NPT is immensely important to international security. The importance of stemming proliferation and, more specifically, extending the Treaty, is growing as a result of the significant changes in the world. If the conferees of the Extension Conference decide on no extension or extension for a short limited duration, some technically advanced states that have foregone development of nuclear weapons may begin to rethink their options. Also, other arms control measures, such as the Chemical Weapons Convention, could start to unravel. The US must provide strong international leadership to ensure that the Extension Conference is a success, resulting in Treaty extension, perhaps through successive terms, into the indefinite future. Workshop participants were struck by the urgent need for the US to take organizational steps so that it is highly effective in its advance preparations for the Extension Conference. Moreover, the Extension Conference provides both a challenge and an opportunity to mold a cohesive set of US policy actions to define the future role of nuclear weapons and combat their proliferation.

3502 Proliferation

Refer also to citation(s) 32603, 32604

33131 (SAND–93-0947) **Stockpile Transition Enabling Program (STEP): Process and project requirements.** Ma, Kwok Kee. Sandia National Labs., Albuquerque, NM (United States). Jun 1993. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018691. Source: OSTI; NTIS; GPO Dep.

The Stockpile Transition Enabling Program (STEP) is aimed at identifying weapon components suitable for use in more than one weapon and for qualifying components so identified for multiple use. Work includes identifying the means to maintain the manufacturing capability for these items. This document provides the participants in STEP a common, consistent understanding of the process and requirements. The STEP objectives are presented and the activities are outlined. The STEP project selections are based on the customer needs, product applicability, and maturity of the technology used. A formal project selection process is described and the selection criteria are defined. The concept of "production readiness" is introduced, along with a summary of the project requirements and deliverables to demonstrate production readiness.

33132 (UCRL-ID–113649) **Nuclear weapons and regional conflict.** Latter, A.L. (Lawrence Livermore National Lab., CA (United States)); Martinelli, E.A. Lawrence Livermore National Lab., CA (United States). May 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93017964. Source: OSTI; NTIS; GPO Dep.

An important national defense objective for the US in the post cold-war era – according to Secretary of Defense, Cheney is to deter regional conflicts. To satisfy this objective there is more or less general agreement that nuclear weapons are not needed, especially against regional powers like Iraq that do not (as yet) have a nuclear capability. Modern conventional weapons (PGMs), it is believed, are adequate when used in the traditional way of fighting: massive ground forces with heavy ground equipment, supported by air and naval forces. Of course, there are arguments against this view. For example, nuclear advocates call attention to deeply buried targets that are unattackable with conventional munitions. But this argument, and others, for US use (or threat of use) of nuclear weapons are presently discounted in favor of the political/moral advantages of a no-first-use policy. We do not wish to take sides in this debate. We believe, however, that the debate win continue as political, military, technical and economic factors undergo inevitable changes. In this brief paper, we want to present another pro-nuclear argument which, to the best of our knowledge, has received little or no attention. This argument, we believe, could become important in weighing the pros and cons of the debate if domestic pressures cause the defense budget to undergo such severe cuts that we must either abandon our political commitments or adopt a non-traditional war-fighting strategy that is effective under a greatly reduced defense budget.

3503 Verification

Refer also to citation(s) 32593, 32603, 32604, 32610, 33014, 33128, 33376, 33744, 33745

33133 (DOE/FTR–93014813) **Travel to Austria to participate in safeguards topic meeting on the Integrated Surveillance Package: Foreign trip report, November 17–22, 1991.** Johnson, C.S. Sandia National Labs., Albuquerque, NM (United States). 22 Jan 1992. 92p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93014813. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The meeting on the Integrated Surveillance Package (ISP) began on November 18, 1991 at the International Atomic Energy Agency in Vienna, Austria. The meeting was led under the chairmanship of Mr. J. Bardsley of Australia. The meeting was opened by Mr. K. Naito, Director of Safeguards Development (DIRSGDE). Mr. Naito stated that the IAEA wanted the workshop to consider how the modern technology, automation, software and hardware could be used to provide communication between optical and radiation systems. Data authentication and tamper protection would also be a part of the Integrated Surveillance Package (ISP). Other presentations were made by Mr. D. Rundquist, Mr. R. Arlt, and Mr. R. Abedin-Zadeh. The presentations were followed by general discussions by the entire group present. The participants were divided into a Concepts Working Group and a Technical Working Group. Mr. R. Keeffe of Canada was selected to serve as chairman of the Concepts Working Group and Mr. C. Johnson was selected to serve as chairman of the Technical Working Group. The two working groups prepared papers on their deliberations. The Conceptual Working Group stated that the major implications of an ISP would be increased IAEA efficiency, remote interrogation, and reduced intrusiveness. The Technical Working Group recommended that the IAEA prepare a survey of existing systems and detailed requirements for an ISP, then convene a small working group of experts to produce a set Of ISP specifications. The group also agreed that an ISP was technically feasible for the IAEA to pursue.

33134 (LA–12619-MS) **COSL dosimetry for application to on-site inspections: A technical review.** Johnson, M.W. (Los Alamos National Lab., NM (United States)); Drigert, M.W. Los Alamos National Lab., NM (United States). Aug 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93018397. Source: OSTI; NTIS; GPO Dep.

A technical review has been conducted of the cooled optically-stimulated luminescence (COSL) technique for high-dynamic-range dosimetry. Hardware and data presented by the technology developers have been examined. Applications of the COSL technology to tasks in treaty verification are identified, and possible problems in implementing the applications are discussed. Recommendations are presented for follow-on studies to resolve unanswered questions regarding the use of COSL in treaty verification.

33135 (LA-UR–93-2586) **Information sources for transparency measures at sensitive facilities.** Stanbro, W.D.; Olinger, C.T.; Close, D.A.; Kniss, B. Los Alamos National Lab., NM (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930749–41: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93018546. Source: OSTI; NTIS; GPO Dep.

The concept of transparency stems from a desire to assure other parties that some action such as the dismantlement of a weapons system is taking place while avoiding the intrusiveness, complexity, and lengthy negotiations associated with formal verification measures. By their nature, transparency measures may fall short of providing the degree of confidence associated with arms control treaties, such as INF or START, but can be more quickly and easily implemented. This paper discusses information sources that could form the basis of transparency measures at sensitive facilities.

33136 (SAND–93-1347C) **Arms control compliance: Information value of verification measures.** Gough, R.G.; Zelicoff, A.P. Sandia National Labs., Albuquerque, NM (United States). Dec 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-931169–1: 24. Decision Sciences Institute national meeting, Washington, DC (United States), Nov 1993). Order Number DE93014997. Source: OSTI; NTIS; GPO Dep.

Using concepts of decision analysis, this paper examines how government policy makers might consider and evaluate the contribution of additional inspection, openness, and confidence-building measures to diplomatic questions involving compliance with arms control agreements. During the current debate among parties to the Biological Weapons Convention as to what constitutes effective verification of compliance with that Convention, these analytical concepts were employed to evaluate some proposed inspection or confidence-building measures. Some of the salient points not bound up in the confidentiality of on-going negotiations will be summarized here.

33137 (SAND–93-1633C) **Secure authenticated video equipment.** Doren, N.E. Sandia National Labs., Albuquerque, NM (United States). [1993]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930749–9: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93017503. Source: OSTI; NTIS; GPO Dep.

In the verification technology arena, there is a pressing need for surveillance and monitoring equipment that produces authentic, verifiable records of observed activities. Such a record provides the inspecting party with confidence that observed activities occurred as recorded, without undetected tampering or spoofing having taken place. The secure authenticated video equipment (SAVE) system provides an authenticated series of video images of an observed activity. Being self-contained and portable, it can be installed as a stand-alone surveillance system or used in conjunction with existing monitoring equipment in a non-invasive manner. Security is provided by a tamper-proof camera enclosure containing a private, electronic authentication key. Video data is transferred communication link consisting of a coaxial cable, fiber-optic link or other similar media. A video review station, located remotely from the camera, receives, validates, displays and stores the incoming data. Video data is validated within the review station using a public key, a copy of which is held by authorized panics. This scheme allows the holder of the public key to verify the authenticity of the recorded video data but precludes undetectable modification of the data generated by the tamper-protected private authentication key.

33138 (SAND–93-1667C) **The Authenticated Tracking and Monitoring System (ATMS) concept.** Schoeneman, J.L. Sandia National Labs., Albuquerque, NM (United States). 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930749–51: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93018855. Source: OSTI; NTIS; GPO Dep.

The Authenticated Tracking and Monitoring System (ATMS) has been designed to address the need for global monitoring of the status and location of proliferation-sensitive items. Conceived to utilize the proposed Global Verification and Location System (GVLS) satellite link, ATMS could use the existing International Maritime Satellite commercial communication system until GVLS is operational. The ATMS concept uses sensor packs to monitor items and environmental conditions, collects a variety of events data through a sensor processing unit, and transmits the data to a satellite, which then sends data to ground stations. Authentication and encryption algorithms will be used to secure the data. A typical ATMS application would be to track and monitor the safety and security of a number of items in transit along a scheduled shipping route. This paper also discusses a possible proof-of-concept system demonstration.

33139 (SAND–93-1714C) **Authenticated In-Plant Process Monitor.** Leahy, P.; Draelos, T. Sandia National Labs., Albuquerque, NM (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930749–31: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93017891. Source: OSTI; NTIS; GPO Dep.

Transparent and secure process monitoring systems may become an important tool in the dismantlement schemes in support of bilateral and multi-lateral treaties. A prototype system, using public key cryptography to authenticate compliance data, has been developed by Sandia National Laboratories. The Authenticated In-plant Process Monitor (AIPM) is an embedded process monitoring system capable of accepting up to sixteen industry standard process variables, at sample rates of up to two samples per second. Each AIPM will synchronously sample the process, authenticate, and transmit the data in real-time to the host receiving station. The receiving station will validate the compliance data and then display in real-time while updating a relational database. This new generation of monitoring systems must include protection from a host of possible threat scenarios while providing the user authentic clear text data. Data threats are controlled by the use of a public key Treaty Data Authentication Module (TDAM) utilizing the National Institute of Standards and Technology (NIST) Digital Signature Standard. System threats are minimized by the use of a tamper indicating enclosure that monitors unauthorized entry and environmental attacks. Insider threats will be controlled by the use of an authenticated bi-directional communication link between each remote AIPM and the host receiving station. This security envelope will be monitored on a real-time basis with appropriate action taken if an attack occurs. The employment of these security features allows the inspectorate to distribute unprocessed clear text data and an attached digital signature with confidence that the data cannot be forged.

33140 (UCRL-JC–113871) **A role for on-site chemical analysis to support CWC inspections.** McGuire, R.R.; Raber, E. Lawrence Livermore National Lab., CA (United States). May 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9306211–1: Defense Nuclear Agency's international conference on controlling arms, Richmond, VA (United States), 7-10 Jun 1993). Order Number DE93018099. Source: OSTI; NTIS; INIS; GPO Dep.

The CWC, when it enters into force, will be unique among arms control treaties in the detail of its verification provisions. Each of the treaty provisions will, at least in principle, be monitored by on-site inspections classified as either routine or challenge. In either type of inspection, inspectors are allowed to collect physical samples for chemical analysis. Available analytical instruments have the resolution and the sensitivity to isolate, detect and identify chemical species present in concentrations of less than parts per trillion in many cases. These capabilities provide powerful tools for CWC inspectors. They also drastically increase the risk for compromise of sensitive information that is not relevant to the CWC. This information may deal with national security issues or confidential business issues. The challenge then is to strike the proper balance between the protection of legitimately sensitive information and providing adequate analytical support to CWC inspectors. The capabilities and limitations of sample collection and chemical analysis have been explored in a number of field experiments at both US government and US industrial facilities. The results of these experiments have led to a better appreciation of the risk to sensitive information and the generation and some testing of methods to prevent disclosure without unduly impacting the effectiveness of the inspection. This report summarizes results from these studies.

36 MATERIALS

Refer also to citation(s) 33012, 33016, 33017, 33106

33141 (ORNL–6760) **Workshop on innovation in materials processing and manufacture: Exploratory concepts for energy applications.** Horton, L.L. (comp.). Oak Ridge National Lab., TN (United States). Jun 1993. 69p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93017674. Source: OSTI; NTIS; GPO Dep.

The goal of the workshop was to bring together industrial, academic, and DOE Laboratory personnel to discuss and identify potential areas for which creative, innovative, and/or multidisciplinary solutions could result in major payoffs for the nation's energy economy, DOE, and industry. The topics emphasized in these discussions were: surfaces and interfacial processing technologies, biomolecular materials, powder/precursor technologies, magnetic materials, nanoscale materials, novel ceramics and composites, novel intermetallics and alloys, environmentally benign materials, and energy efficiency. The workshop had a 2-day format. One the first day, there was an introductory session that summarized future directions within DOE's basic and materials technology programs, and the national studies on manufacturing and materials science and engineering. The balance of the workshop was devoted to brainstorming sessions by seven working groups. During the first working group session, the entire group was divided to discuss topics on: challenges for hostile environments, novel materials in transportation technologies, novel nanoscale materials, and opportunities in biomolecular materials. For the second session, the entire group (except for the working group on biomolecular materials) was reconfigured into new working groups on: alternative pathways to energy efficiency, environmentally benign materials and processes, and waste treatment and reduction: a basic sciences approach. This report contains separate reports from each of the seven working groups.

33142 (SAND–92-0535C) **Reducing inadvertent alloying of metal/ceramic brazes.** Stephens, J.J.; Hlava, P.F. Sandia National Labs., Albuquerque, NM (United States). [1992]. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-931154–1: Minerals and Materials Metals Society meeting on low thermal expansion alloys and composites, Chicago, IL (United States), 1-5 Nov 1993). Order Number DE93009842. Source: OSTI; NTIS; GPO Dep.

Inadvertent alloying of Cu braze metal can compromise metal/ceramic seals. Electron microprobe analyses have quantified alloying of Cu brazes in metal/ceramic feedthroughs. Pin material and processing parameters above 1084C both affect alloying levels. Using either Kovar or Ni-plated 316L stainless steel pins limits alloying compared to Palco pins. Minimizing the time during which the braze is molten also avoids excessive alloying. The original thickness of the Ni plating on the Mo-Mn metallization of the ceramic also influences the alloying content of these brazes. Metal/ceramic brazes made with long brazing cycles, Mo-Mn metallization, and Kovar components grow a layer of $Mo_6(Fe_{3.5}CO_{3.5})_7$ on the metallization. Layer thicknesses observed do not appear to compromise joint integrity. Ni additions of approximately 10 and 20 wt.% to Cu apparently increases the stress required for stress relaxation during cooldown. to maintain creep rates required for stress relaxation during cooldown. Relative to unalloyed Cu, this strengthening effect tends to increase as temperature is decreased.

3601 Metals and Alloys

Refer also to citation(s) 32221, 32523, 32654, 32655, 32684, 32718, 32772, 32803, 32804, 32807, 32893, 32901, 32929, 32972, 32973, 33274, 33349, 33391, 33403, 33442, 33708, 34453, 34456, 34472, 34538, 34542, 34543, 34544, 34545, 34546, 34547, 34548, 34549, 34550, 34551, 34552, 34553, 34554, 34555, 34556, 34557, 34558, 34559, 34560, 34561, 34562, 34563, 34564, 34565, 34566, 34567, 34568, 34569, 34570, 34571, 34573, 34580, 34608, 34626

33143 (ANL/ET/CP–78882) **Modeling of the formation of microporosity in alloys.** Chang, F.C. (Argonne National Lab., IL (United States)); Tsai, H.L. Argonne National Lab., IL (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31-109-ENG-38. (CONF-930796–3: 1993 Chinese American Academic and Professional convention, Chicago, IL (United States), 2-5 Jul 1993). Order Number DE93017733. Source: OSTI; NTIS; GPO Dep.

A complete mathematical model, consisting of a continuum model and a gas evolution model, was established for the prediction of shrinkage- and gas-caused porosity in castings. The model allows simultaneous calculation of transient temperature, velocity, pressure, and porosity distributions in a solidifying casting. Fluid flow caused by both natural convection and solidification contraction, as well as change of global domain due to shrinkage, were considered. A parametric study was performed to investigate the effects of various solidification variables in the formation of

microporosity, including the use of chilling, initial gas content, characteristics of heat transfer between the casting and the mold, casting size, and riser height. It was found that a low initial gas content in the molten metal and casting conditions that facilitate solidification-rate decrease the formation of microporosity. The calculated porosity distribution in 1% Cr-steel alloys compares favorably with published experimental data.

33144 (ANL/MSD/CP–79243) **Neutron-induced collision cascade mixing in Nb/V superlattices.** Alexander, D.E.; Fullerton, E.E.; Baldo, P.M.; Sowers, C.H.; Rehn, L.E. Argonne National Lab., IL (United States). Jul 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930712–1: ICACS: 15. international conference on atomic collision in solids, London (Canada), 26-30 Jul 1993). Order Number DE93018575. Source: OSTI; NTIS; INIS; GPO Dep.

High-angle X-ray diffraction was used to determine cascade mixing efficiencies, Dt/dpa, in Nb/V superlattices irradiated to small doses ($\leq$0.26 dpa). Samples were neutron irradiated in the core of the High Flux Beam Reactor at Brookhaven National Laboratory and ion irradiated with 1.5 MeV Ne. No significant differences were observed in cascade mixing efficiencies between the two types of irradiation. Values of Dt/dpa were observed to vary with the modulation wavelength of the superlattice, with thicker wavelength samples yielding values approaching that determined from ion mixing thick Nb/V bilayers (Dt/dpa$\approx$110 Å^2/dpa). The decrease in mixing efficiency observed at lower wavelengths may be related to an observed structural transition in which the interfaces of the superlattice become coherent.

33145 (CEA-CONF–11310) **Tungsten and tungsten-carbon PVD-multilayered structures as erosion resistant coatings.** Ouesnel, E. (CEA Centre d'Etudes de Grenoble, 38 (France). Dept. d'Etudes des Materiaux); Pauleau, Y.; Monge-Cadet, P.; Brun, M. CEA Centre d'Etudes de Grenoble, 38 (France). Dept. d'Etudes des Materiaux. 1993. 24p. (CONF-930419–4: International conference on metallurgical coatings and thin films, San Diego, CA (United States), 19-23 Apr 1993). Order Number DE93515323. Source: OSTI; NTIS (US Sales Only).

The present paper deals with the elaboration and characterization of tungsten/tungsten-carbon multilayer coatings produced by magnetron sputtering. This low temperature PVD process, compared to CVD processes, enables to deposit protective coatings on TA6V substrates at temperatures below 400 deg C. The microhardness of W-C films was found strongly dependent on carbon concentration. This change in microhardness with the carbon content was correlated with the evolution of the cristallographic structure. Multilayers coatings of 60 μm in total thickness composed of various W/W-C stacking arrangements have been elaborated with hard W-C films containing 14-15 at% or 40-45 at% of carbon. These samples were submitted to erosive wear tests using a sand blast unit. W/W-C coatings with an appropriate stacking arrangement and a carbon concentration of 14-15 at% in W-C layers exhibited an erosion resistance improved by more than two orders of magnitude compared to that of uncoated TA6V substrates. (Author). 10 refs., 7 figs., 2 tabs.

33146 (CONF-920673–23) **Effects of irradiation temperature on Charpy and tensile properties of high-copper, low upper-shelf, submerged-arc welds.** Nanstad, R.K.; Berggren, R.G. Oak Ridge National Lab., TN (United States). [1992]. 30p. Sponsored by USDOE, Washington, DC (United States); Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. From 16. annual symposium of American Society of Testing and Materials (ASTM) on effects of radiation on materials; Denver, CO (United States); 21-25 Jun 1992. Order Number DE93017858. Source: OSTI; NTIS; GPO Dep.

This paper presents analyses of the Charpy impact and tensile test data, including adjustments for irradiation temperature and fluence normalization which make possible comparison of the irradiation sensitivity of the different welds. Analyses revealed dependence of yield and ultimate strength on irradiation temperature −0.8 MPA/°C, respectively. Similarly, the Charpy impact energy changes due to irradiation temperature were −0.5°C/°C for transition shift and −0.05 J/°C for upper-shelf energy decrease. After adjustment to an irradiation temperature of 288°C and normalization to a fluence of 8×10^{18} neutrons/cm^2 percentage increases in yield strength due to irradiation ranged from about 21 to 35% while those for ultimate strength ranged from about 13 to 20%. The Charpy transition temperature shifts ranged from 59 to 123°C while the postirradiation upper-shelf energies ranged from 58 to 79 J.

33147 (CONF-9211205–3) **Deformation mechanisms in a Laves phase.** Liu, Yaping; Allen, S.M.; Livingston, J.D. Massachusetts Inst. of Tech., Cambridge, MA (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-90ER45426. From High-temperature ordered intermetallic alloys V; Boston, MA (United States); 30 Nov - 3 dec 1992. Order Number DE93018331. Source: OSTI; NTIS; INIS; GPO Dep.

The stress-induced phase transformation between C36 and C15 structures in Fe_2Zr is studied by electron microscopy. Nucleus of transformation is believed to be pre-existing C15 layers in C36 particles. Microstructural evidence for three mechanisms of growth of a new phase were found: Fault accumulation and rearrangement, moving of a individual partial dislocations between two phases, and the migration of microscopic ledges composed of a series of Shockley partials between C36 and C15. Plastic deformation by slip on non-basal planes of C36 caused by indentation is studied.

33148 (CONF-9211205–4) **Morphology, deformation, and defect structures of $TiCr_2$ in Ti-Cr alloys.** Chen, K.C.; Allen, S.M.; Livingston, J.D. Massachusetts Inst. of Tech., Cambridge, MA (United States). [1992]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-90ER45426. From High-temperature ordered intermetallic alloys V; Boston, MA (United States); 30 Nov - 3 dec 1992. Order Number DE93018332. Source: OSTI; NTIS; INIS; GPO Dep.

The morphologies and defect structures of $TiCr_2$ in several Ti-Cr alloys have been examined by optical metallography, x-ray diffraction, and transmission electron microscopy (TEM), in order to explore the room-temperature deformability of the Laves phase $TiCr_2$. The morphology of the Laves phase was found to be dependent upon alloy composition and annealing temperature. Samples deformed by compression have also been studied using TEM. Comparisons of microstructures before and after deformation suggest an increase in twin, stacking fault, and dislocation density within the Laves phase, indicating some but not extensive room-temperature deformability.

33149 (CONF-930202–11) **Prediction of non-equilibrium solidification modes in austenitic stainless steel laser welds.** Vitek, J.M.; David, S.A. Oak Ridge National Lab., TN (United States). [1993]. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Annual meeting of the Metallurgical Society; Denver, CO (United States); 21-25 Feb 1993. Order Number DE93018457. Source: OSTI; NTIS; GPO Dep.

A primary austenitic, non-equilibrium mode of solidification can be induced in many 300 series austenitic stainless steels by laser welding and other rapid solidification techniques. The change in solidification mode can often result in a fully austenitic microstructure compared to the two phase ferrite plus austenite microstructure that is commonly found after primary ferrite solidification. A predictive capability for the solidification mode under rapid solidification conditions such as laser welding is needed since the microstructure and properties are closely related to solidification behavior. Conventional constitutional diagrams do not predict with any reliability the change to non-equilibrium austenitic solidification mode. Several means that have been attempted to predict the solidification behavior under extreme conditions are reviewed. The Cr_{EQ}/Ni_{EQ} ratio is shown to be unreliable, at least with the equivalence factors commonly used. Theoretical calculations of growth rate competition between ferrite and austenite solidification show promise, but some ambiguity results from inaccuracy in thermophysical material parameters. Use of calculated thermodynamic parameters such as equilibrium and non-equilibrium liquidus and solidus temperatures also shows some promise. However, this approach is not completely satisfactory and reliable either. It is concluded that a reliable and accurate method for predicting the tendency of austenitic stainless steels to solidify in the non-equilibrium mode is not yet available.

33150 (CONF-9305135–7) **Tensile properties of as-cast iron-aluminide alloys.** Viswanathan, S.: McKamey, C.G.; Maziasz, P.J.; Sikka, V.K. Oak Ridge National Lab., TN (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 7. annual conference on fossil energy materials; Oak Ridge, TN (United States); 11-13 May 1993. Order Number DE93017852. Source: OSTI; NTIS; GPO Dep.

Room-temperature tensile properties of as-cast Fe_3Al, Fe_3Al with chromium, and Fe_3Al-based FA-129 alloy are investigated. Tensile properties were obtained in the as-cast condition and after homogenization at 700, 900, and 1200°C. Transmission electron microscopy (TEM) was used to characterize ordered phases, and optical metallography and scanning electron microscopy (SEM) were used to characterize the microstructure and fracture morphology. The results indicate that the low ductility of as-cast Fe_3Al-based alloys may be related to the relatively large grain size in the cast condition, the low dislocation density in as-cast samples, and the presence of the DO_3 ordered phase. Homogenized samples of FA-129 alloy exhibited almost twice the ductility of the as-cast condition. Microstructural characterization of the homogenized samples and comparison of the as-cast and homogenized microstructures may provide a clue to the poor ductility in the as-cast state.

33151 (CONF-9305135–8) **Development of ductile Fe_3Al-based aluminides.** McKamey, C.G.; Sikka, V.K.; Goodwin, G.M. Oak Ridge National Lab., TN (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 7. annual conference on fossil energy materials; Oak Ridge, TN (United States); 11-13 May 1993. Order Number DE93017865. Source: OSTI; NTIS; GPO Dep.

Iron aluminides based on Fe_3Al are of interest because of their excellent oxidation and corrosion resistance, especially in sulfur-bearing atmospheres. Work at ORNL has centered on developing Fe_3Al-based alloys with improved ambient temperature ductilities and increased strengths at temperatures of 600–700C. Ambient temperature brittleness in this system is not "inherent," but is caused by atomic hydrogen which is produced by an environmental reaction between aluminum in the alloy and water vapor in the atmosphere. Great strides have been made in understanding this embrittlement Phenomenon, and the production of alloys with room temperature ductilities of over 10% and tensile yield strengths at 600C of as high as 500 MPa is now possible through modifications in alloy composition and control of thermomechanical processing techniques. Creep rupture lifes of over 200 h at 593C (1100°F) and 207 MPa (30 ksi) can also be produced through control of alloy composition and microstructure. This paper summarizes our present efforts to improve the tensile and creep rupture properties and gives the status of efforts to commercialize Fe_3Al-based alloy compositions.

33152 (CONF-9305135–9) **Low-aluminum-content iron-aluminum alloys.** Sikka, V.K.; Baldwin, R.H.; Howell, C.R. Oak Ridge National Lab., TN (United States). [1993]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 7. annual conference on fossil energy materials; Oak Ridge, TN (United States); 11-13 May 1993. Order Number DE93017862. Source: OSTI; NTIS; GPO Dep.

The low room-temperature ductility Fe_3Al-based alloys is associated with their environmental embrittlement. Reducing the aluminum level from 29 to 16 at % has been found to be an effective method in essentially eliminating the environmental-embrittlement effect and increasing the room-temperature ductility value to over 25%. This paper will present data on alloy compositions, melting, casting and processing methods, and mechanical properties. Plans for future work on these alloys will also be described.

33153 (CONF-930825–3) **Atom probe field ion microscopy characterizations of VVER steels.** Miller, M.K. (Oak Ridge National Lab., TN (United States)); Jayaram, R.; Othen, P.J.; Brauer, G. Oak Ridge National Lab., TN (United States). [1993]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 6. international symposium on environmental degradation of materials in nuclear power systems: water reactors; San Diego, CA (United States); 3-5 Aug 1993. Order Number DE93017864. Source: OSTI; NTIS; INIS; GPO Dep.

An atom probe field ion microscopy (APFIM) characterization of Soviet types 15Kh2MFA Cr-Mo-V (VVER 440) and 15Kh2NMFA Ni-Cr-Mo-V (VVER 1000) pressure vessel steels has been performed. Field ion microscopy has revealed that the lath boundaries in unirradiated VVER 440 and VVER 1000 steels are decorated with a thin film of brightly-imaging molybdenum carbonitride precipitates and some coarser vanadium carbides. Atom probe analysis has revealed significant enrichments of phosphorous at the lath boundaries.

33154 (DOE/ER/45162–T1) **[Electronic and structural properties of individual nanometer-size supported metallic clusters]: Final performance report.** Reifenberger, R. Purdue Univ., Lafayette, IN (United States). [1993]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-84ER45162. Order Number DE93040078. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the work performed under contract DOE-FCO2-84ER45162. During the past ten years, our study of electron emission from laser-illuminated field emission tips has taken on a broader scope by addressing problems of direct interest to those concerned with the unique physical and chemical properties of nanometer-size clusters. The work performed has demonstrated that much needed data can be obtained on individual nanometer-size clusters supported on a wide-variety of different substrates. The work was performed in collaboration with R.P. Andres in the School of Chemical Engineering at Purdue University. The Multiple Expansion Cluster Source developed by Andres and his students was essential for producing the nanometer-size clusters studied. The following report features a discussion of these results. This report provides a motivation for studying the properties of nanometer-size clusters and summarizes the results obtained.

33155 (DOE/ER/45326–T3) **[Realistic theories of heavy electron and other strongly correlated materials].** Ohio State Univ. Research Foundation, Columbus, OH (United States). [1993]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-87ER45326. Order Number DE93010350. Source: OSTI; NTIS; INIS; GPO Dep.

Research on the following topics is summarized: non-perturbative treatments of multi-channel Kondo models, non-perturbative treatments of multi-band models for the quadrupolar fluctuation model of the cuprates, extension of the two-channel Kondo model to other materials and treatment of the infinite-dimensional Hubbard model within the Non-crossing approximation. Data on the specific heat of $Y_{0.8}U_{0.2}Pd_3$ and the c-axis susceptibility and specific heat of U in $ThRu_2Si$ are shown. 5 figs., 84 refs.

33156 (DOE/ER/45328–7) **Surface phases and their influence on metal-oxide interfaces: Progress report.** Blakely, J. Cornell Univ., Ithaca, NY (United States). Dept. of Materials Science and Engineering. Jan 1993. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-87ER45328. Order Number DE93019931. Source: OSTI; NTIS; GPO Dep.

This project is concerned with adsorbed monolayers on metal surfaces and their effects on oxidation kinetics and metal-oxide adhesion; proposed work is a study of metallurgy of 2-dimensional systems with emphasis on binary adsorbed layers. Experimental techniques which can be used include electron diffraction, atomic force and tunneling microscopy, environmental SEM, and secondary electron spectroscopies. Intention is to try to extract information on adsorbate interactions through comparison with model predictions; initially simple pair interaction potentials will be used. Atomic steps on single crystal surfaces, which affect nucleation/growth of overlayers, will be extended to metal oxide systems to form atomic step arrays as preferential sites for surface nucleation of oxides etc. Adsorbed (or segregated) monolayers at metal/oxide interfaces also affect adhesion and further oxidation. S and O adsorption on Ni and NiFe alloy surfaces were studied and are discussed.

33157 (DOE/ER/45367–5) **A free energy simulation method based study of interfacial segregation: Annual progress report, FY 1992.** Srolovitz, D.J. Michigan Univ., Ann Arbor, MI

(United States). 18 May 1993. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-88ER45367. Order Number DE93019462. Source: OSTI; NTIS; GPO Dep.

Binary alloys were investigated. Segregation to and thermodynamics of twist grain boundaries in Cu-Ni were studied. Segregation to and order-disorder phase transitions at grain boundaries in ordered $Ni_{3-x}Al_{1+x}$ were also investigated. Order-disorder transitions at and segregation to the (001), (011), and (111) surfaces in Pd-Cu, Pd-Ag, and Pd-Au alloys were investigated. The (001) surface in Cu-rich alloys undergoes a surface phase transition from disordered to ordered surface phase upon cooling from high temperature, similar to the (001) surface transition in Ni-rich Pt-Ni alloys. Segregation and ordering appear to be correlated. The free energy minimization method was also used to calculate the heat of formation and lattice parameter of Ag-Cu metastable phases. Results of free energy minimization for free energy and entropy of Si agree with experiment and quasiharmonic calculations.

33158 (DOE/ER/52161–5) **The effects of radiolysis on the corrosion and stress corrosion behavior of 316 stainless steels.** Duquette, D.J.; Steiner, D. Rensselaer Polytechnic Inst., Troy, NY (United States). [1993]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-89ER52161. Order Number DE93019932. Source: OSTI; NTIS; GPO Dep.

This program is focused on the corrosion, stress corrosion and corrosion fatigue behavior of Type 316 stainless steel (316SS) at 50, 90, and 130 C in high-purity water. Irradiated solution tests are performed using high-energy photon radiation. Purpose of this work is to determine the effects of radiolysis products on the environmental stability of 316SS in support of the ITER first wall/shield/blanket design. Preliminary results suggest that irradiation of pure water at 50 C results in a shift in the electrochemical potential for 316SS of approximately 100mV in the active direction and nearly an order of magnitude increase in the passive current density as compared to non-irradiated conditions. This proposal outlines a three-year program to develop corrosion design criteria for the use of 316SS in an ITER environment.

33159 (ETDE-IT–93-205) **Passivation characteristics of beta-FeAl intermetallic compound in sulphate solutions.** Frangini, S. (ENEA, Casaccia (Italy). Dipt. Tecnologie Intersettoriali di Base); De Cristofaro, N.; Lascovich, J.C.; Mignone, A. 1992. 11p. (CONF-9206234–3: International conference on advances in corrosion and protection, Manchester (United Kingdom), 28 Jun - 3 jul 1992). Order Number DE93523005. Source: OSTI; NTIS (US Sales Only).

The corrosion and passivation behaviour of a Fe-24 wt% Al intermetallic compound was studied in sulphate solutions using cyclic voltammetry and potentiodynamic curves, combined with x-ray photoelectron spectrocopy (XPS). The voltagrams performed in H_2SO_4 0.5M show the peak characteristics of the oxidation/reduction process of iron. The comparison of the anodic polarization curve of FeAl in acid solution with those of the pure elements shows the beneficial effect of Al when added to Fe in terms of both passive range and current. At higher pH (6.0 and 13.6), the FeAl passivates spontaneously. Preliminary studies of the passive film grown in air and anodically performed by XPS revealed the co-existence of iron and aluminium oxide, thus explaining the superior corrosion resistance of iron aluminides as compared with iron.

33160 (INIS-mf–13548, pp. 3-11) **Investigations of chromium steels radiation embrittlement.** Shamardin, V.K. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (Russian Federation)); Pecherin, A.M.; Vishkarev, O.M.; Borisov, V.P.; Tulyakov, G.A. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 9.* 225p. Order Number DE94600002. Source: OSTI; NTIS (US Sales Only); INIS.

Impact toughness of irradiated chromium steels produced by different technologies has been investigated. It has been shown that increase of radiation resistance for 10Kh9M, 10Kh9M2 and O5Kh14N5M2 steels can be obtained as the result of smelting technology improvement - use of pure charge and electroslag remelt. 3 refs.; 6 figs.; 4 tabs. (author).

33161 (INIS-mf–13548, pp. 12-18) **Resistance to the fragile destruction of reactor vessels with account of irradiation influence.** Vasnin, A.M. (Nauchno-Issledovatel'skij i Konstruktorskij Inst. Ehnergotekhniki, Moscow (Russian Federation)); Rivkin, E.Yu. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 9.* 225p. Order Number DE94600002. Source: OSTI; NTIS (US Sales Only); INIS.

A general principle of nuclear reactor vessel materials brittle destruction using linear elastic mechanics methods for destruction calculation is described. 4 refs.; 3 figs.; 2 tabs. (author).

33162 (INIS-mf–13548, pp. 27-33) **Influence of ultra-sound action on the low-temperature embrittlement of 15Kh2MFA and 15Kh2MNFA steels.** Aksenov, V.K. (AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst.); Volchok, O.I.; Gindin, I.A.; Neklyudov, I.M.; Ozhigov, L.S. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 9.* 225p. Order Number DE94600002. Source: OSTI; NTIS (US Sales Only); INIS.

Microstructure particularities formed during ultra-sound action on reactor vessel steels were studied and their influence on embrittlement of these steels during the following irradiation by high-energy electrons and fast neutrons was investigated. It was shown that the ultra-sound action leads to a considerable relaxation of loadings in steels. 8 refs.; 4 figs.; 4 tabs. (author).

33163 (INIS-mf–13548, pp. 91-99) **Change of electrophysical properties of GaAs under the high-energy electron radiation.** Neklyudov, I.M. (AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst.); Polyashenko, R.F.; Kovalenko, I.V.; Malets, E.B.; Samokish, S.A. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 9.* 225p. Order Number DE94600002. Source: OSTI; NTIS (US Sales Only); INIS.

Experimental data on radiation-induced defects in GaAs crystal and electrophysical properties of GaAs under the electron radiation are presented. They were obtained by methods of thermostimulated exoelectron emission, internal friction, by measurements of electrical conductivity and EMF of Hall effect. Increase of dose to $2.9 \times 10^{18} cm^{-2}$ cause the sharp change of electrophysical properties of GaAs: electrical conductivity decrease on several orders, inversion of conductivity type take place at 250 K, current carriers scattering mechanism changes at 200 K, the material become ductile. Our experimental data characterize GaAs + 10^{16}Cr to be more radiation-resistant, than Si. 6 refs.; 13 figs.; 1 tab. (author).

33164 (INIS-mf–13548, pp. 100-103) **The materials for tenso resistor.** Shakhovtsova, S.I. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Fiziki); Shvarts, M.M.; Belokurova, I.N. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 9.* 225p. Order Number DE94600002. Source: OSTI; NTIS (US Sales Only); INIS.

The method of forming of the radiation hard tenso-resistor from the $Ge_{1-x}Si_x$ alloys are presented. The processes of radiation damages in $Ge_{1-x}Si_x$ depending on doping degree and irradiated temperature was studied. The stability of electrical properties of material is accounted by peculiarities of radiation damages at high temperature. 4 refs.; 2 figs.; 2 tabs. (author).

33165 (INIS-mf–13548, pp. 104-108) **Influence of thermal defects on the radiation defects creation in silicon.** Neimash, V.B. (Laboratory Materials Solid State Microelectronics, Drogobych (Ukraine)); Siratsky, V.M.; Shakhovtsov, V.I.; Shindich, V.L. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 9.* 225p. Order Number DE94600002. Source: OSTI; NTIS (US Sales Only); INIS.

Mechanisms of influence of preliminary heat treatments and thermal defects created at such heat treatments on the kinetics of the main secondary radiation defects (RD) accumulation in silicon, and also on the behaviour of the silicon electro physics parameters under irradiation was investigated. 8 refs.; 4 figs.; 1 tab. (author).

33166 (INIS-mf–13548, pp. 113-122) **Thermo-radiative stability of the materials based on solid alloy of silicon-germanium n- and p-type in reactor neutron field.** Marchuk, N.D. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Dolgolenko, A.P.; Kolychev, N.N. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 9.* 225p. Order Number DE94600002. Source: OSTI; NTIS (US Sales Only); INIS.

N- and P-type samples of silicon-germanium solid alloy with specific resistance (1/2)x$10^{-3}\Omega$cm doped with mixture of natural phosphorus and boron during irradiation in the active core of the WWR-M reactor at temperature of (200-500)^{0}C were studied. The dose dependence of the specific resistance and thermo-emf of the samples based on silicon-germanium solid alloy was described in frameworks of the effective medium theory. In accordance with this theory the clusters defects are considered as dielectric insertions in conducting sample matrix. 10 refs.; 4 figs.; 2 tabs. (author).

33167 (INIS-mf–13548, pp. 158-165) **Investigation of structure and superconducting properties of Nb, Nb-Ti and Nb_3Sn irradiated by helium ions.** Shishov, V.N. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Neorganicheskikh Materialov, Moscow (Russian Federation)); Sokurskij, Yu.M. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 9.* 225p. Order Number DE94600002. Source: OSTI; NTIS (US Sales Only); INIS.

Influence of helium implantation and following annealings on the structure and superconducting properties of Nb, Nb-Ti alloys and Nb_3Sn compositions were studied. It was shown that radiation defects are effective centres of pinning. 9 refs.; 6 figs.; 1 tab. (author).

33168 (INIS-mf–13548, pp. 198-205) **Radiation stimulated grain-boundary slipping and radiation creeping of polycrystalline materials.** Bereznyak, P.A. (AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst.); Kornilov, S.P. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 9.* 225p. Order Number DE94600002. Source: OSTI; NTIS (US Sales Only); INIS.

A new mechanism of radiation creeping based on the theory of viscous flow in a polycrystal matter was formulated. It considers creeping as a balance between boundary migration and grain-boundary slipping processes. The idea of a new class of crystalline structure defect existence (zero-dimension or point ground-boundary dislocations) is proposed. 10 refs.; 3 figs. (author).

33169 (INIS-mf–13549, pp. 15-20) **Summary modification of the phase's reaction in thin Cu-Si, Mo-Si films by the γ-radiation.** Shpilevskij, Eh.M. (AN Belorusskoj SSR, Minsk (Belarus). Inst. Yadernoj Ehnergetiki); Gol'tsev, V.P.; Fedyushin, E.E.; Barinov, V.I.; Dmitriev, S.M.; Yazychenko, S.A. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 10.* 214p. Order Number DE94600067. Source: OSTI; NTIS (US Sales Only); INIS.

The radiation-stimulated acceleration of the phase's growth has been established. The process of the phase's growth was depended on state boundaries of the division between the metal-silicon layers. 3 refs.; 5 figs. (author).

33170 (INIS-mf–13549, pp. 21-24) **Radiation-induced defects in $YA10_3$ crystals.** Ermakov, G.A. (Nauchno-proizvodstvennoe ob"edinenie "Polyus", Moskva (Russian Federation)); Akkerman, V.A.; Vajnshtejn, D.I.; Mizamutdinov, N.M.; Bulka, G.P. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 10.* 214p. Order Number DE94600067. Source: OSTI; NTIS (US Sales Only); INIS.

γ-radiation induced defects are investigated by methods of optical, ESR and NMR spectroscopies in $YA10_3$. Experimental data allow to suggest generation of associative defects [Fe^{2+}-O^-] localized on crystal portion with disordered structure. 10 refs.; 2 figs. (author).

33171 (INIS-mf–13549, pp. 25-31) **Effect of γ-radiation on optical and electro-optical parameters of $LiTaO_3$ crystals.** Ermakov, G.A. (Nauchno-proizvodstvennoe ob"edinenie "Polyus", Moskva (Russian Federation)); Karasev, V.N.; Nosov, V.P. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 10.* 214p. Order Number DE94600067. Source: OSTI; NTIS (US Sales Only); INIS.

Effect of γ-radiation on optical characteristics and polarization process of $LiTaO_3$ crystals grown with application of Pt-Rn crucibles. 8 refs.; 6 figs. (author).

33172 (INIS-mf–13549, pp. 50-52) **Influence of the reactor radiation on the magnetic properties yttrium ferrite garnets films.** Danilov, V.V. (Kievskij Gosudarstvennyj Univ., Kiev (Ukraine)); Litovchenko, P.G.; Rudenko, G.G. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 10.* 214p. Order Number DE94600067. Source: OSTI; NTIS (US Sales Only); INIS.

It was determined that irradiation by fast neutrons does not change magnetic relaxation parameters of yttrium-iron garnets. At the same time irradiation by neutrons of the whole reactor spectrum influences on film properties. 4 refs.; 2 figs. (J.A.).

33173 (INIS-mf–13549, pp. 67-71) **Channeling study of the localization of carbon atoms and crystal structure defects in the Re-$^{13}C_x$ system.** Skakun, N.A. (AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst.); Kovtun, G.P.; Olejnik, V.A.; Deev, A.S.; Svetashov, P.A.; Grinchenko, A.Yu. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 10.* 214p. Order Number DE94600067. Source: OSTI; NTIS (US Sales Only); INIS.

The method of 1753 keV proton channeling and the resonant nuclear reaction $^{13}C(p,\gamma)^{14}N$ were used to investigate the localization of carbon atoms and the defect structure of the Re-$^{13}C_x$ system as functions of the carbon content. The examination of the Re-$^{13}C_x$ system in the range of concentrations x between 0.7 and 1.5 at.% ^{13}C has revealed three fractions of carbon atoms: (i) interstitial solution, where the carbon atoms are localized in octahedral interstitial lattice sites of rhenium; (ii) clusters of several carbon atoms with a particular orientation to the Re crystal cell; (iii) carbon precipitate, anisotropically distributed in different crystallographic planes of Re. 2 refs.; 2 figs. (author).

33174 (INIS-mf–13549, pp. 72-77) **A study of radiation damages in Ion-irradiated iron yttrium garnets.** Skakun, N.A. (AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst.); Grinchenko, A.Yu.; Deev, A.S.; Olejnik, V.A.; Svetashov, P.A. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 10.* 214p. Order Number DE94600067. Source: OSTI; NTIS (US Sales Only); INIS.

Backscattering of channeled particles and resonant nuclear reactions have been used to study radiation damages of epitaxial layers in garnets implanted with 80 keV boron and nitrogen ions to doses between 10^{14} and $10^{16}cm^{-2}$. It is shown that even at a nitrogen ion dose of $1.5x10^{14}cm^{-2}$ a complete randomization of the crystal subsurface areas takes place. With boron implantation, however,

no randomization occurs until doses of $10^{16}cm^{-2}$. The annealing of radiation defects can be realized at temperature not below 900^0C. Localization of boron and nitrogen atoms in the lattice cell, and also their depth distributions are established. 12 refs.; 5 figs. (author).

33175 (INIS-mf–13549, pp. 105-112) **Slow neutron scattering study of oxygen and nitrogen interstitial atoms vibrations in vanadium.** Danilkin, S.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (Russian Federation). Fiziko-Ehnergeticheskij Inst.); Minaev, V.P. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 10.* 214p. Order Number DE94600067. Source: OSTI; NTIS (US Sales Only); INIS.

Slow neutron spectroscopy results on frequency spectrum of solid solution vanadium-oxygen and vanadium-nitrogen is presented. It is shown that metal atom frequency distribution is deformed. Spectrum frequencies increased in spite of lattice dilatation caused by interstitial atoms. Deformation of spectrum is discussed in frame of virtual crystal approximation. Oxygen and nitrogen atoms frequencies is compared with computer simulation results. Interatomic potentials vanadium-nitrogen and vanadium-oxygen conformed with neutron spectroscopy data is presented. 8 refs.; 4 figs.; 2 tabs. (author).

33176 (INIS-mf–13549, pp. 126-132) **High-energy heavy-ion irradiation facility for simulation experiments on macroscopic specimens over 10 dpa.** Szenes, G. (Eoetvoes Lorand Tudomanyegyetem, Budapest (Hungary)); Havancsak, L.; Murgas, L.; Shchegolev, V.A. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 10.* 214p. Order Number DE94600067. Source: OSTI; NTIS (US Sales Only); INIS.

Preliminary experiments have been performed on 30 μm copper foils irradiated through an absorber with ^{20}Ne beams of the U-400 cyclotron of JINR (Dubna). The yield stress change and the direct estimation show an increase of the effective defect production rate by a factor of 12.5 due to the absorber. For a 600 MeV $^{64}Cu^{+9}$ beam a further increase in effectivity by a factor of 8 is estimated leading to irradiation up to 1 dpa within 21 hours. With an ECR ion source a specimen with a thickness of 20 μm can be irradiated over 10 dpa within the same time. 4 refs.; 4 figs. (J.P.).

33177 (INIS-RU–347, pp. 415) **NMR studies of steel type EhK-73 alloying with chromium and associated processes.** Amulyavichyus, A.S.; Bal'chyunene, M.; Sipavichyus, Ch.S. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. STEELS/laser radiation; STEELS/phase studies; CHROMIUM ADDITIONS; DIFFUSION; IMPURITIES; LAYERS; MELTING; STEELS; SURFACES

33178 (INIS-RU–347, pp. 416) **Study of NGR factors determining Fe-W alloy formation at laser synthesis.** Amulyavichyus, A.S.; Bal'chyunene, M.; Petretis, Br. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. IRON ALLOYS/moessbauer effect; IRON ALLOYS/synthesis; TUNGSTEN ALLOYS/moessbauer effect; TUNGSTEN ALLOYS/synthesis; BINARY ALLOY SYSTEMS; SYNTHESIS; LASER RADIATION; PULSED IRRADIATION; SOLID SOLUTIONS

33179 (INIS-RU–353, pp. 8-11) **Investigation on the growth microprecipitations in silicon.** Kalyuzhnaya, G.A.; Kuznetsov, S.P.; Meshkov, I.V.; Perekrestenko, A.D.; Sal'nik, Z.A. AN SSSR, Moscow (Russian Federation). Fizicheskij Inst. 1991. (In Russian). In *Short communications on physics. Experimental and theoretical physics. No. 9.* 48p. Order Number DE94600071. Source: OSTI; NTIS (US Sales Only); INIS.

The origin and development of microheterogeneities in silicon monocrystals grown by the Czochralski method and differing in the thermal histories, were investigated using the method of very cold neutron (VCN) scattering. The experiment showed, that the different thermal histories determine the sufficiently different electric parameters of crystals at close sizes and concentrations of microheterogeneities in them. The experimental data analysis has indicated that the process of the thermal donor formation is connected with the microprecipitation size increase at their concentration decrease. The microprecipitations, which were not observed earlier, were revealed by the VCN method for the first time. The possible model of the thermal donor formation process was suggested.

33180 (LA–12370-MS) **The potential of centrifugal casting for the production of near net shape uranium parts.** Robertson, E. (United States Air Force Academy, Colorado Springs, CO (US). Dept. of Engineering Mechanics). Los Alamos National Lab., NM (United States). Sep 1993. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93019687. Source: OSTI; NTIS; INIS; GPO Dep.

This report was written to provide a detailed summary of a literature survey on the near net shape casting process of centrifugal casting. Centrifugal casting is one potential casting method which could satisfy the requirements of the LANL program titled Near Net Shape Casting of Uranium for Reduced Environmental, Safety and Health Impact. In this report, centrifugal casting techniques are reviewed and an assessment of the ability to achieve the near net shape and waste minimization goals of the LANL program by using these techniques is made. Based upon the literature reviewed, it is concluded that if properly modified for operation within a vacuum, vertical or horizontal centrifugation could be used to safely cast uranium for the production of hollow, cylindrical parts. However, for the production of components of geometries other than hollow tubes, vertical centrifugation could be combined with other casting methods such as semi-permanent mold or investment casting.

33181 (LA-UR–93-2214) **Influence of peak pressure and temperature on the shock-loading response of tantalum.** Gray, G.T. III. Los Alamos National Lab., NM (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930676–33: 14. international conference of the International Association for the Advancement of High Pressure Science and Technology, Colorado Springs, CO (United States), 27 Jun - 2 jul 1993). Order Number DE93018561. Source: OSTI; NTIS; GPO Dep.

While the deformation response of tantalum subjected to high-rate loading has attracted considerable study, few studies have systematically investigated the influence of peak shock pressure and starting temperature on the shock response of tantalum. In this study the deformation behavior of annealed tantalum has been compared to tantalum shock pre-strained to 7 and 15 GPa at 250C as well as to 7 GPa after first preheating to 200 and 4OOC. The reload yield behavior of shock prestrained Ta was found to exhibit no enhanced shock hardening compared to Ta deformed quasi-statically or dynamically to an equivalent strain level. In addition the reload yield behavior of Ta shock prestrained to 7 GPa at 200 or 400C was found to exhibit increased hardening compared to the shock prestraining at 25C. The shock-hardening response of Ta is discussed in terms of defect storage and compared to that seen in fcc metals.

33182 (LA-UR–93-2290) **Effects of shock loading on a solid-solution strengthened superalloy.** Vecchio, K.S. (California Univ., San Diego, La Jolla, CA (United States). Dept. of Applied Mechanics and Engineering Sciences); Gray, G.T. III. Los Alamos National Lab., NM (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-36.

DAAL03-92-G-0108. (CONF-930676–17: 14. international conference of the International Association for the Advancement of High Pressure Science and Technology, Colorado Springs, CO (United States), 27 Jun - 2 jul 1993). Order Number DE93018345. Source: OSTI; NTIS; GPO Dep.

Ni-based HAYNES® 23O™ ALLOY has been studied to determine the effect of shock loading on post-shock quasistatic and dynamic mechanical response, and microstructural evolution. Compression properties of this material was studied in both the as-received and shock-loaded conditions at strain rates from 10^{-3}/s to 3000/s, and 77 and 293K. Damage evolution was documented via TEM and correlated with observed mechanical response. Changes in deformation mechanisms and second phase distributions resulting from shock pre-straining and subsequent testing are correlated with changes in strain hardening behavior. Comparison of these results with shock loading results on pure Ni revealed distinct differences in strengthening and defect storage mechanisms.

33183 (LA-UR–93-2339) **A review of the stages of work hardening.** Rollett, A.D.; Kocks, U.F. Los Alamos National Lab., NM (United States). [1993]. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9304166–1: Dislocations '93, Assois (France), 1-9 Apr 1993). Order Number DE93016456. Source: OSTI; NTIS; GPO Dep.

Stages of work hardening are reviewed with emphasis on links between each stage. Simple quantitative descriptions are given for each stage. Similarities between stage I, easy glide, and stage IV, large strain hardening, are pointed out both in terms of magnitude of the hardening rate and of the underlying mechanism of dislocation debris accumulation. Stage II is described as an athermal hardening stage that occurs when statistical variations in the dislocation "forest" lead to geometrical storage of dislocations. The steadily decreasing hardening rate observed in stage III is characterized by the increasing rate of loss of dislocation density due to dynamic recovery. Stage III appears to have an asymptote to a saturation stress which is determined by the characteristics of the dislocation tangles, or cell walls. The imperfect nature of the dynamic recovery process, however, leads to the accumulation of dislocation debris and this, by analogy with stage 1, causes the apparent saturation stress to rise, thus causing stage IV.

33184 (LA-UR–93-2499) **Elastic properties of amorphous thin films studied by Rayleigh waves.** Schwarz, R.B.; Rubin, J.B. Los Alamos National Lab., NM (United States). [1993]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9308140–2: 8. international conference on rapidly quenched and metastable materials, Sendai (Japan), 22-27 Aug 1993). Order Number DE93018375. Source: OSTI; NTIS; INIS; GPO Dep.

Physical vapor deposition in ultra-high vacuum was used to co-deposit nickel and zirconium onto quartz single crystals and grow amorphous $Ni_{1-x}Zr_x$ ($0.1 < x < 0.87$) thin film. A high-resolution surface acoustic wave technique was developed for in situ measurement of film shear moduli. The modulus has narrow maxima at x = 0. 17, 0.22, 0.43, 0.5, 0.63, and 0.72, reflecting short-range ordering and formation of aggregates in amorphous phase. It is proposed that the aggregates correspond to polytetrahedral atom arrangements limited in size by geometrical frustration.

33185 (LA-UR–93-2739) **Magnetic and crystallographic structures in UTX intermetallic compounds.** Robinson, R.A. (Los Alamos National Lab., NM (US)); Lawson, A.C.; Sechovsky, V.; Havela, L.; Kergadallan, Y.; Nakotte, H.; de Boer, F.R. Los Alamos National Lab., NM (United States). 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930905–1: Actinides '93, Santa Fe, NM (United States), 19-24 Sep 1993). Order Number DE93018291. Source: OSTI; NTIS; GPO Dep.

Uranium, along with other actinides and lanthanides, forms a large group of ternary intermetallic compounds of stoichiometry UTX (T = transition metal, X = p-electron metal). These compounds are formed in several structure types and the occurrence and stability of particular structures with respect to the transition metal content suggests reasonable systematics. The authors have also investigated the magnetic structures of selected UTX compounds and it is revealing to relate the crystallographic and magnetic structures, because of the relationship between the magnetic symmetry and that of the U-atom environment produced by the 5f-ligand hybridization, and the consequent anisotropic exchange. Those of ZrNiAl structure type are collinear, with moments along the hexagonal c-axis. In the orthorhombic NiSiTi structure type, the moments are confined to the b- c plane (perpendicular to the uranium chains) and the structures are often incommensurate. In the hexagonal $CaIn_2$ (or GaGeLi) structure type, the magnetic structures form in an orthorhombic cell, and at least in the disordered centric group, again the moments lie perpendicular to the nearest-neighbor uranium spacing. This work presents a phenomenology of trends in UTX ternary compounds. It is shown that there is an apparent strong hybridization parallel to nearest neighbor U-U directions, with ferromagnetic coupling in the same directions. There may be a systematic relationship between the hybridization anisotropy and the magnetic anisotropy, in which the quantization axes are the same and the moments point along directions of relatively weak hybridization.

33186 (LA-UR–93-2799) **Dislocation-drag contribution to high-rate plastic deformation in shock-loaded tantalum.** Tonks, D.L.; Hixson, R.S.; Johnson, J.N.; Gray, G.T. III. Los Alamos National Lab., NM (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930676–29: 14. international conference of the International Association for the Advancement of High Pressure Science and Technology, Colorado Springs, CO (United States), 27 Jun - 2 jul 1993). Order Number DE93018286. Source: OSTI; NTIS; GPO Dep.

Time-resolved plastic waves in plate-impact experiments give information on relation between applied shear stress and plastic strain rate at low plastic strain. This information is different from that obtained at intermediate strain rates using Hopkinson bar techniques, because the material deformation state is driven briefly into the regime dominated by dislocation drag. Two VISAR records of particle velocity at the tantalum/sapphire (window) interface are obtained for symmetric impact producing peak in-situ longitudinal stresses of 75 and 111 kbar. Rise-times of plastic waves are about l00 and 50 ns, respectively, with peak strain rates of about $2 \times l0^5$ and $8.5 \times l0^5$/s, respectively, as determined by weak-shock analysis. These data show a much stronger dependence of plastic strain rate on applied shear stress than predicted by linear viscous drag models in combination with thermal activation through a large Peierls barrier. The data also show complex evolution of the mobile dislocation density during early stages of high-rate plastic flow. This measurement and corresponding analysis aid significantly in establishing the fundamental picture of dynamic deformation of metals and the evolution of the internal material state at early times following shock compression.

33187 (LBL–34291) **The effect of composition on the mechanism of continuous recrystallization and superplastic response of aluminum-scandium alloys.** Bradley, E.L. III. Lawrence Livermore National Lab., CA (United States). May 1993. 102p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93018594. Source: OSTI; NTIS; GPO Dep.

The continuous recrystallization (CRX) appears to be fundamental in Al-Sc because it occurs irrespective of solute composition. It appears to be due to a combination of subgrain coalescence at low strains and incorporation of additional dislocations generated during grain boundary sliding at higher strains when the misorientation has increased sufficiently. Alloying additives such as Mg, Li are more important with respect to deformation after CRX is completed. Mg, and to a lesser extent Li, affect the max m-values (strain-rate sensitivities) in Al-Sc by changing the melting points (mp). Max m- values correlate inversely with mp so that the alloy with the greatest Mg had the highest m-values and lowest mp; the stress is raised at which power-law creep and breakdown occurs. The power-law breakdonw at much lower stresses in Al-0.5Sc and Al-1.2Li-0.5Sc causes the m-value to decrease more rapidly with strain rate. Al alloys for commercial superplastic applications should contain elements that raise the power-law strength so that

the m-values are maximized while preserving the post-formed mechanical properties. Refs, figs, tabs.

33188 (MAO-PR–92-01) **Factors which affect fatigue strength of fasteners.** Skochko, G.W.; Herrmann, T.P. General Electric Co., Schenectady, NY (United States). Nov 1992. 19p. Order Number DE93017272. Source: OSTI; NTIS.

Axial load cycling fatigue tests of threaded fasteners are useful in determining fastener fatigue failure or design properties. By using appropriate design factors between the failure and design fatigue strengths, such tests are used to establish fatigue failure and design parameters of fasteners for axial and bending cyclic load conditions. This paper reviews the factors which influence the fatigue strength of low Alloy steel threaded fasteners, identifies those most significant to fatigue strength, and provides design guidelines based on the direct evaluation of fatigue tests of threaded fasteners. Influences on fatigue strength of thread manufacturing process (machining and rolling of threads), effect of fastener membrane and bending stresses, thread root radii, fastener sizes, fastener tensile strength, stress relaxation, mean stress, and test temperature are discussed.

33189 (NUTEK-FBT–93-5) **High resolution electron microscopy of catalytic substances - especially zeolites and metals: Final report.** Bovin, J.O. (National Center for HREM, Inorganic Chemistry 2, Chemical Center, Lund (Sweden)); Wallenberg, R. Swedish National Board for Industrial and Technical Development (NUTEK), Stockholm (Sweden). [1992]. 86p. Project NUTEK-276-332. Order Number DE93795066. Source: OSTI; NTIS.

The only method to visualize the structure at the atomic level, including all its defects, is by High Resolution Electron Microscopy (HREM). The materials studied in this project includes oxides, zeolites and metals. To elucidate the so called SMSI, strong metal-support interaction, where the catalytic performance of an active phase is strongly enhanced by attaching it closely to an (inactive) support, a broad investigation was performed of a thin-layer catalyst, exhibiting this effect. Loadings corresponding to from a 1/4 of a monolayer, up to 10 monolayers of vanadium oxide on a TiO_2(B), a new type of support, was tried for ammoxidation and partial oxidation of aromatic substances. The maximum performance for a 2-monolayer loading was shown to be due to a specific strained surface phase induced by, and identical in structure to, the support. Through HREM and structural modelling, a mechanism could be suggested for the formation of structurally incorporated voids in the TiO_2(B) support material. Chemical contemplation on the mechanism could then be used to increase the number of voids to form interpenetrating channels, thereby increasing the surface area considerably. Our group is developing new concepts for using HREM methods to determine metal clusters inside zeolites. This is paired with synthesis efforts in collaborating groups.

33190 (ORNL/FTR–4600) **Travel to United Kingdom for meeting on the evaluation of steel components: Foreign trip report, April 24–28, 1993.** Bass, B.R. Oak Ridge National Lab., TN (United States). 14 May 1993. 24p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93015470. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The traveler participated in the initial meeting of Task Group 1 (TG 1) of the International Network for Evaluating Steel Components (NESC). Membership in the NESC is open to international technical organizations concerned with methods and practices of structural integrity assessment. Task Group 1 is charged with addressing issues related to inspection and nondestructive examination of steel components for the purpose of detecting and sizing defects. (There are four other task groups that address materials, test conditions, instrumentation, and exploitation.) The objectives of this meeting were to agree on Terms of Reference for TG 1 and to discuss blind-inspection stages for a reference experiment. The UK Health and Safety Executive has proposed that a project involving a large-scale spinning cylinder test be used to initiate the NESC program; the test would be performed by AEA Technology. The project is intended to provide a focused problem for study by a wide range of organizations involved in reactor pressure vessel (RPV) assessments. This would include issues related to inspection, assessment and behavior of underclad cracks in simulated aged RPV material under pressurized-thermal-shock loading conditions.

33191 (ORNL/FTR–4654) **Travel to Germany for planning of the fracture analysis of large-scale international reference experiments (FALSIRE) project: Foreign trip report, May 28–June 11, 1993.** Bass, B.R. Oak Ridge National Lab., TN (United States). 25 Jun 1993. 25p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93017237. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Detailed discussions were held with researchers at Gesellschaft fuer Anlagen-und Reaktorischerheit (GRS), Koeln, Germany, concerning the organization and planning for Phase II of the Project FALSIRE. Project FALSIRE is organized by the Fracture Assessment Group (FAG) of the Organization for Economic Cooperation and Development/Nuclear Energy Agency's (OECD/NEA) Committee on the Safety of Nuclear Installations (CSNI) Principal Working Group No. 3 (PWG-3). On behalf of the CSNI/FAG, the Heavy-Section Steel Technology (HSST) Program at Oak Ridge National Laboratory (ORNL) and GRS have responsibility for organizational arrangements related to Project FALSIRE. The primary focus of experiments was on the behavior of relatively shallow cracks under conditions that relate to pressurized-thermal-shock loading in a reactor pressure vessel (RPV). A summary of each experiment is included in this report.

33192 (ORNL/TM–12341) **Commercialization effort in support of electroslag-casting technology.** Sikka, V.K. Oak Ridge National Lab., TN (United States). Jun 1993. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93017988. Source: OSTI; NTIS; GPO Dep.

This report summarizes the results of an effort to revive interest in the electroslag casting (ESC) of components in the United States. The ESC process is an extension of a well established electroslag-remelting (ESR) process. Both processes use the electrode of a material that is continuously melted and cast in a water-cooled copper mold. For simple shapes, the mold can be movable, allowing the continuous casting of long lengths. In an effort to revive US industries' interest in ESC, the following approaches were taken: (1) US industries with prior experience in ESC or currently operating an ESR unit were contacted, followed up with telephone conversation, and/or sent copies of prior published reports on the topic, and, in some cases, personal visits were made; (2) with two companies, a potential interest in ESC was worked out by initially conducting ESR; and (3) to further strengthen the industrial interest, the newly developed iron-aluminide alloy, FA-129, was chosen as the material of choice for this study. The two industrial companies that worked with ORNL were Special Metals Corporation (New Hartford, New York) and Precision Rolled Products, Inc. (PRP) [Florham Park, New Jersey]. Even with its advantages, a survey of the industry indicated that ESC technology has a very limited chance of advancement in the United States. However, the processing of rounds and slabs by the ESR process is a well established commercial technology and will continue to expand. 16 figs, 3 tabs, 12 refs.

33193 (PNL-SA–21235) **High dose effects in neutron irradiated face-centered cubic metals.** Garner, F.A. (Pacific Northwest Lab., Richland, WA (United States)); Toloczko, M.B. Pacific Northwest Lab., Richland, WA (United States). Jun 1993. 47p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9310133–1: Time dependence of radiation damage accumulation and its impact on material properties, Montreau (Switzerland), 14-21 Oct 1993). Order Number DE93017671. Source: OSTI; NTIS; INIS; GPO Dep.

During neutron irradiation, most face-centered cubic metals and alloys develop saturation or quasi-steady state microstructures. This, in turn, leads to saturation levels in mechanical properties and quasi-steady state rates of swelling and creep deformation. Swelling initially plays only a small role in determining these saturation states, but as swelling rises to higher levels, it exerts strong feedback on the microstructure and its response to environmental variables. The influence of swelling, either directly or indirectly via

second order mechanisms, such as elemental segregation to void surfaces, eventually causes major changes, not only in irradiation creep and mechanical properties, but also on swelling itself. The feedback effects of swelling on irradiation creep are particularly complex and lead to problems in applying creep data derived from highly pressurized creep tubes to low stress situations, such as fuel pins in liquid metal reactors.

33194 (RFP–4739) **Effect of internal heating during hot compression testing on the stress-strain behavior and hot working characteristics of Alloy 304L.** Mataya, M.C.; Sackschewsky, V.E. EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant. [1993]. 80p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC34-90DP62349. (CONF-931009–1: Fall meeting of the Minerals, Metals and Materials Society: physical metallurgy and materials in conjunction with materials week and the Materials Applications and Services Exposition, Pittsburgh, PA (United States), 17-21 Oct 1993). Order Number DE93012701. Source: OSTI; NTIS; GPO Dep.

Temperature change from conversion of deformation to internal heat, and its effect on stress-strain behavior of alloy 304L was investigated by initially isothermal (temperature of specimen, compression dies, environment equilibrated at initiation of test) uniaxial compression. Strain rate was varied 0.01 s^{-1} to 1 s^{-1} (thermal state of specimen varied from nearly isothermal to nearly adiabatic). Specimens were deformed at 750 to 1150 to a strain of 1. Change in temperature with strain was calculated via finite element analysis from measured stress-strain data and predictions were confirmed with thermocouples to verify the model. Temperature increased nearly linearly at the highest strain rate, consistent with temperature rise being a linear function of strain (adiabatic). As strain rate was lowered, heat transfer from superheated specimen to cooler dies caused sample temperature to increase and then decrease with strain as the sample thinned and specimen-die contact area increased. As-measured stress was corrected. Resulting isothermal flow curves were compared to predictions of a simplified method suggested by Thomas and Shrinivasan and differences are discussed. Strain rate sensitivity, activation energy for deformation, and flow curve peak associated with onset of dynamic recrystallization were determined from both as-measured and isothermal stress-strain data and found to vary widely. The impact of utilizing as-measured stress-strain data, not corrected for internal heating, on results of a number of published investigations is discussed.

33195 (SAND–93-0390C) **Effect of phase change in a debris cloud on a backwall structure.** Kmetyk, L.N.; Chhabildas, L.C.; Boslough, M.B.; Lawrence, R.J. Sandia National Labs., Albuquerque, NM (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930676–8: 14. international conference of the International Association for the Advancement of High Pressure Science and Technology, Colorado Springs, CO (United States), 27 Jun - 2 jul 1993). Order Number DE93017506. Source: OSTI; NTIS; GPO Dep.

The physical state of a debris cloud generated upon impact of a thin flier plate with a thin bumper depends on the impact velocity. At impact velocities of 10km/s, the debris cloud is expected to be primarily molten with some vapor present. A series of calculations using the finite-difference code CTH has been used to evaluate the effect of phase change (i.e., higher concentrations of vapor) in debris clouds and their subsequent impact on a backwall structure. In these calculations, the higher concentrations of vapor is achieved by increasing the initial temperature of the impactor and the bumper material while keeping the same impact velocity. The nature of the interaction of the debris cloud and the subsequent loading on the backwall depends on its thermophysical state. This interaction (with a backwall) can cause either spallation, rupture, or simply bulging of the backwall structure. These results will be discussed and compared with an impact experiment performed at ~10km/s on the Sandia hypervelocity launcher. In the experiment, the debris cloud was generated by the impact of a titanium plate with a titanium bumper.

33196 (SAND–93-0427C) **Dynamical behavior of tantalum.** Furnish, M.D. (Sandia National Labs., Albuquerque, NM (US)); Chhabildas, L.C.; Steinberg, D.J. Sandia National Labs., Albuquerque, NM (United States). 1993. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930676–10: 14. international conference of the International Association for the Advancement of High Pressure Science and Technology, Colorado Springs, CO (United States), 27 Jun - 2 jul 1993). Order Number DE93017877. Source: OSTI; NTIS; GPO Dep.

The authors have performed four dynamic impact tests on tantalum to determine its high-pressure yield and viscoelastic properties. Their experiments used compressed gas gun techniques to produce a combination of shocks, reshocks and releases over the pressure range 0–12 GPa in samples 5.0 and 7.3 mm thick. Profiles were recorded using VISAR (velocity interferometry) techniques. Elastic precursors suggest a yield strength of 0.95 GPa, which is somewhat above literature values. As with other metals, release waves do not show a perfect elastic-plastic behavior, indicating a slight Baushinger effect. Lagrangian sound velocities for singly shocked states are consistent with earlier results (about 4.5 km/sec).

33197 (SAND–93-0763) **Metallurgical evaluation of SRAM II/SRAM A programmer base plates.** Damkroger, B.K.; Maguire, M.C.; Robino, C.V. Sandia National Labs., Albuquerque, NM (United States). May 1993. 65p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018689. Source: OSTI; NTIS; GPO Dep.

Ten MC4073/4369 programmer base plates were analyzed. This component, a programmer base plate for the SRAM II (and later the SRAM A), is specified as a Grade C quality casting made of aluminum Alloy A356, heat treated to the T6 condition. A concern was expressed regarding the choice of an A356 casting for this application, given the complexity and severity of the loading environment. Preliminary tests and analyses suggested that the design was adequate, but noted the uncertainty involved in a number of their underlying assumptions. The uncertainty was compounded by the discovery that the casting used in the original series of mechanical tests failed. In this investigation, several production castings were examined and found to be of a quality superior to that required under current specifications. Their defect content and microstructure were studied and compared with published data to establish a mechanical property data base. The data base was supplemented with a series of X-direction static tests, which characterized the loading environment and measured the overall casting performance. It was found that the mechanical properties of the supplied castings were adequate for the anticipated X-direction loading environment, but the component is not over-designed. The established data base further indicates that a reduction in casting quality to the allowable level could result in failure of the component. Recommendations were made including (1) change the component specification to require higher casting quality in highly stressed areas, (2) supplement the inspection procedures to ensure adequate quality in critical regions, (3) alter the component design to reduce the stress levels in the mounting feet, (4) substitute a modified A356 alloy to improve the mechanical properties and their consistency, and (5) more thoroughly establish a data base for the mechanical property consequences of levels and configurations of casting defects.

33198 (SAND–93-1206) **Sandia equation of state data base: seslan File.** Kerley, G.I. (Sandia National Labs., Albuquerque, NM (US)); Christian-Frear, T.L. Sandia National Labs., Albuquerque, NM (United States). 24 Jun 1993. 57p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018693. Source: OSTI; NTIS; GPO Dep.

Sandia National Laboratories maintains several libraries of equation of state tables, in a modified Sesame format, for use in hydrocode calculations and other applications. This report discusses one of those libraries, the seslan file, which contains 78 tables from the Los Alamos equation of state library. Minor changes have been made to these tables, making them more convenient for code users and reducing numerical difficulties that occasionally arise in hydrocode calculations.

33199 (SAND–93-1455C) **A new multiphase equation of state for iron.** Kerley, G.I. Sandia National Labs., Albuquerque, NM (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789.

(CONF-930676–6: 14. international conference of the International Association for the Advancement of High Pressure Science and Technology, Colorado Springs, CO (United States), 27 Jun - 2 jul 1993). Order Number DE93017629. Source: OSTI; NTIS; GPO Dep.

The PANDA code was used to develop an equation of state (EOS) for iron. Separate EOS tables were constructed for four solid phases and the fluid phase. The phase diagram and multiphase EOS table were then computed using the free energies. Results are in good agreement with thermophysical, static compression, phase boundary, and shock-wave measurements. Predicted pressures for the shock-induced ϵ-γ and γ-liquid transitions agree with those determined from sound speed measurements. Predicted melting temperatures fall in between two recent sets of experimental data which sharply disagree with one another.

33200 (SP–93-13) **Variable amplitude fatigue, modelling and testing.** Svensson, Thomas. Swedish National Testing and Research Inst., Boraas (Sweden). 1993. 56p. (In English, Swedish). Order Number DE94600069. Source: OSTI; NTIS; INIS.

Problems related to metal fatigue modelling and testing are here treated in four different papers. In the first paper different views of the subject are summarised in a literature survey. In the second paper a new model for fatigue life is investigated. Experimental results are established which are promising for further development of the mode. In the third paper a method is presented that generates a stochastic process, suitable to fatigue testing. The process is designed in order to resemble certain fatigue related features in service life processes. In the fourth paper fatigue problems in transport vibrations are treated.

33201 (UCRL-CR–112526) **Software for x-ray optics research instrumentation: Final report, 1991.** Knight, L.V. (Brigham Young Univ., Provo, UT (US)). Lawrence Livermore National Lab., CA (United States); Brigham Young Univ., Provo, UT (United States). Mar 1992. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93019914. Source: OSTI; NTIS; GPO Dep.

The statement of work for this contract between The Regents of the University of California and Brigham Young University called for the implementation of computer controlled substrate motion in an existing DC magnetron sputtering system. This task entailed the design and fabrication of a vacuum compatible motor drive and substrate holder, the system had to be capable of closed loop microcomputer control which required the development of a suitable computer interface and control software. Concurrent with this task, the existing magnetron sputtering system was to be upgraded to permit ion assisted deposition. This required modification of the existing sputtering hardware to permit independent control of voltages applied to the substrate and other additional electrode assemblies. In addition to design, fabrication and installation of the system modifications a systematic study of Mo-Si multilayer coatings grown using ion assisted deposition was undertaken. These studies served, in part, as training of LLNL personnel in the ion assisted deposition technique.

33202 (UCRL-JC–111666) **Cutting and drilling studies using high power visible lasers.** Kautz, D.D.; Dragon, E.P.; Werve, M.E.; Hargrove, R.S.; Warner, B.E. Lawrence Livermore National Lab., CA (United States). 27 May 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-921256–7: 1992 international conference on lasers, Houston, TX (United States), 7-11 Dec 1992). Order Number DE93019149. Source: OSTI; NTIS; INIS; GPO Dep.

High power and radiance laser technologies developed at Lawrence Livermore National Laboratory such as copper-vapor and dye lasers show great promise for material processing tasks. Evaluation of models suggests significant increases in welding, cutting, and drilling capabilities, as well as applications in emerging technologies such as micromachining, surface treatment, and stereolithography. Copper lasers currently operate at 1.8 kW output at approximately three times the diffraction limit and achieve mean time between failures of more than 1,000 hours. Dye lasers have near diffraction limited beam quality at greater than 1.0 kW. Results from cutting and drilling studies in titanium and stainless steel alloys show that cuts and holes with extremely fine features can be made with dye and copper-vapor lasers. High radiance beams produce low distortion and small heat-affected zones. The authors have accomplished very high aspect ratios (> 60:1) and features with micron scale (5-50 μm) sizes. The paper gives a description of the equipment; discusses cutting theory; and gives experimental results of cutting and drilling studies on Ti-6Al-4V and 304 stainless steel.

33203 (UCRL-JC–112347) **Molecular dynamics modeling of the mechanical behavior of metallic multilayers.** Belak, J.; Boercker, D.B. Lawrence Livermore National Lab., CA (United States). Apr 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930304–31: 205. American Chemical Society national meeting, Denver, CO (United States), 28 Mar - 2 apr 1993). Order Number DE93017972. Source: OSTI; NTIS; INIS; GPO Dep.

Constant-stress molecular dynamics simulations are used to study the mechanical properties of equal concentration Cu-Ni (111) metallic multilayers of repeat lengths 0.4–0.5 nm. Uniaxial stress is applied along the close-packed and perpendicular to the close-packed directions within the (111) plane. The observed elastic moduli do not display a supermodulus effect as observed in experimental bulge tests for the biaxial modulus. However, both the average interlayer spacing and the out-of-plane Poisson ratio display anomalous effects for multilayer repeat lengths below about two nanometers.

33204 (UCRL-JC–112438) **Recent studies of short-range order in alloys: The Cowley theory revisited.** Reinhard, L. (Lawrence Livermore National Lab., CA (United States)); Moss, S.C. Lawrence Livermore National Lab., CA (United States). 8 Feb 1993. 34p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract W-7405-ENG-48. Grant DMR-9208450. (CONF-9301114–2: John M. Crowley symposium on ultramicroscopy, Scottsdale, AZ (United States), 5-8 Jan 1993). Order Number DE93016416. Source: OSTI; NTIS; GPO Dep.

We present comparisons of various statistical theories for effective pair interactions (EPI) in alloys. We then evaluate these EPI's using the Cowley theory, the Krivoglaz-Clapp-Moss (KCM) approximation, the γ-expansion method (GEM) of Tokar, Masanskii and coworkers, and the exact inverse Monte Carlo (IMC) method, introduced by Gerold and Kern. Via a series of model calculations on a hypothetical bcc alloy with a single nearest-neighbor interaction we show that the Cowley theory is successful in evaluating the EPI's in more dilute alloys but tends to overestimate the magnitude of the nearest neighbor energy at higher concentrations, whereas the KCM expression becomes increasingly inaccurate at lower concentrations. In general, however, the approximate mean field theories are most accurate at higher concentrations and higher temperatures. Recent studies of short-range order in single crystals are discussed in which these EPI's have been evaluated using the IMC, KCM, GEM and Cowley theories. Examples include the bcc alloy $Fe_{0.53}Cr_{0.47}$ and the fcc alloys Cu_3 Au, $CU_{0.69}Zn_{0.31}$ and $Ni_{0.89}BgCr_{0.11}$. In all cases the approximate expressions do quite well, especially the GEM.

33205 (UCRL-JC–113151) **The influence of the target strength model on computed perforation.** Reaugh, J.E. Lawrence Livermore National Lab., CA (United States). Jun 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930676–32: 14. international conference of the International Association for the Advancement of High Pressure Science and Technology, Colorado Springs, CO (United States), 27 Jun - 2 jul 1993). Order Number DE93018659. Source: OSTI; NTIS; GPO Dep.

The authors used an axi-symmetric, two-dimensional Eulerian computer simulation program to simulate the penetration of a tungsten rod with length to diameter ratio L/D = 10 into a thick steel target, and the same rod into finite steel plates of thicknesses between 0.9 and 1.3 L. They compare the perforation limit with the semi-infinite penetration depth at the same velocity (the excess thickness) when the model for target strength is constant yield stress, and when the model incorporates work hardening and thermal softening. The authors also compare their computed results

with available experimental results, which show an excess thickness of about 1 rod diameter.

33206 (UCRL-MA–108598) **CAST2D: A finite element computer code for casting process modeling.** Shapiro, A.B. (Lawrence Livermore National Lab., CA (United States)); Hallquist, J.O. Lawrence Livermore National Lab., CA (United States). Oct 1991. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93019920. Source: OSTI; NTIS; GPO Dep.

CAST2D is a coupled thermal-stress finite element computer code for casting process modeling. This code can be used to predict the final shape and stress state of cast parts. CAST2D couples the heat transfer code TOPAZ2D and solid mechanics code NIKE2D. CAST2D has the following features in addition to all the features contained in the TOPAZ2D and NIKE2D codes: (1) a general purpose thermal-mechanical interface algorithm (i.e., slide line) that calculates the thermal contact resistance across the part-mold interface as a function of interface pressure and gap opening; (2) a new phase change algorithm, the delta function method, that is a robust method for materials undergoing isothermal phase change; (3) a constitutive model that transitions between fluid behavior and solid behavior, and accounts for material volume change on phase change; and (4) a modified plot file data base that allows plotting of thermal variables (e.g., temperature, heat flux) on the deformed geometry. Although the code is specialized for casting modeling, it can be used for other thermal stress problems (e.g., metal forming).

33207 (WAPD-T–2989) **Environmental degradation of Alloy 600 and welded filler metal EN82 in an elevated temperature aqueous environment.** Webb, G.L. Westinghouse Electric Corp., West Mifflin, PA (United States). Bettis Atomic Power Lab. [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC11-89PN38014. (CONF-930825–4: 6. international symposium on environmental degradation of materials in nuclear power systems: water reactors, San Diego, CA (United States), 3-5 Aug 1993). Order Number DE93018049. Source: OSTI; NTIS; INIS; GPO Dep.

The stress corrosion cracking (SCC) behavior of Alloy 600 and welded nickel base filler metal EN82 in high temperature water was investigated. A regression model was developed to show the effects of stress and temperature on SCC initiation for Alloy 600 tubing. An activation energy of 50.6 kcal/mole and a stress exponent of -5.7, applicable to these heats of low temperature mill annealed tubing, were determined from the regression analysis. Data are also presented on the SCC behavior of other classes of materials, including low temperature thermally treated tubing, hot worked and annealed ring forgings, and EN82 weld metal in relation to the tubing data.

33208 (WAPD-T–3010) **Hydrogen pickup and redistribution in alpha-annealed Zircaloy-4.** Kammenzind, B.F. (Bettis Atomic Power Lab., West Mifflin, PA (United States)); Franklin, D.G.; Duffin, W.J.; Peters, H.R. Bettis Atomic Power Lab., West Mifflin, PA (United States). Jul 1993. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC11-89PN38014. (CONF-9307115–1: Electric Power Research Institute (EPRI) utility-industry workshop on pressurized-water reactor (PWR) fuel rod corrosion, Washington, DC (United States), 28-30 Jul 1993). Order Number DE93018050. Source: OSTI; NTIS; INIS; GPO Dep.

Zircaloy-4, which is widely used as a core structural material in Pressurized-Water Reactors (PWR), picks up hydrogen during service. Hydrogen solubility in Zircaloy-4 is low and hydrides precipitate after the Zircaloy-4 matrix becomes slightly supersaturated with hydrogen. These hydrides embrittle the Zircaloy-4. To study hydrogen pickup and concentration a postirradiation nondestructive radiographic technique for measuring hydrogen concentration was developed and qualified. Experiments on hydrogen pickup were conducted in the Advanced Test Reactor (ATR). Out-of-pile tests were conducted to determine the conditions for which hydrogen would migrate. Finally, a phenomenological model was built and indexed to the data. This presentation describes the experiments and the model, presents the results of experiments, and compares the model predictions to experimental results.

33209 (WHC-EP–0667) **Technical evaluation: 300 Area steam line valve accident.** Westinghouse Hanford Co., Richland, WA (United States). Aug 1993. 162p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93019985. Source: OSTI; NTIS; INIS; GPO Dep.

On June 7, 1993, a journeyman power operator (JPO) was severely burned and later died as a result of the failure of a 6-in. valve that occurred when he attempted to open main steam supply (MSS) valve MSS-25 in the U-3 valve pit. The pit is located northwest of Building 331 in the 300 Area of the Hanford Site. Figure 1-1 shows a layout of the 300 Area steam piping system including the U-3 steam valve pit. Figure 1-2 shows a cutaway view of the approximately 10- by 13- by 16-ft-high valve pit with its various steam valves and connecting piping. Valve MSS-25, an 8-in. valve, is located at the bottom of the pit. The failed 6-in. valve was located at the top of the pit where it branched from the upper portion of the 8-in. line at the 8- by 8- by 6-in. tee and was then "blanked off" with a blind flange. The purpose of this technical evaluation was to determine the cause of the accident that led to the failure of the 6-in. valve. The probable cause for the 6-in. valve failure was determined by visual, nondestructive, and destructive examination of the failed valve and by metallurgical analysis of the fractured region of the valve. The cause of the accident was ultimately identified by correlating the observed failure mode to the most probable physical phenomenon. Thermal-hydraulic analyses, component stress analyses, and tests were performed to verify that the probable physical phenomenon could be reasonably expected to produce the failure in the valve that was observed.

33210 (WSRC-TR–93-015) **Upset welding process for 21-6-9 spherical vessels.** Kanne, W.R.Jr. Westinghouse Savannah River Co., Aiken, SC (United States). Feb 1993. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93018194. Source: OSTI; NTIS; GPO Dep.

This report discusses an upset resistance welding process which was developed to fabricate high quality spherical vessels from forged 21-6-9 stainless steel. The two hemishells of the vessels were joined at the girth using solid-state upset welding. Vessels passed nondestructive examinations (X-ray radiography, proof and leak tests, volume and dimensional measurements) and destructive examinations (burst tests and metallography). A set of six high quality vessels was produced. These vessels are 1.86 inches in diameter with a threaded boss and tube on top.

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Refer also to citation(s) 32163, 32336, 32337, 32691, 32803, 32804, 32971, 33112, 33145, 33198, 33201, 33206, 33254, 33331, 33422, 33451, 33551, 33688, 33696, 34486, 34541, 34572, 34574, 34575, 34576, 34577, 34581, 34582, 34584

33211 (ANL/ET/CP–77180) **Quantification of volume flaw sizes in ceramics by image processing of 3D x-ray tomographic data sets.** Stinson, M.C. (Dept. of Computer Science, Central Michigan Univ., Mount Pleasant, MI (United States)); Holloway, D.A.; Ellingson, W.A. Argonne National Lab., IL (United States). Jan 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930164–13: 17. annual conference on composites and advanced ceramics, Cocoa Beach, FL (United States), 11-15 Jan 1993). Order Number DE93018573. Source: OSTI; NTIS; GPO Dep.

This paper introduces a technique to quantify internal flaws in a ceramic body. The approach uses data images obtained from 3D X-ray computed tomography. An approach called guided segmentation uses image processing methods applied to a series of the data images to quantify the flaw volumes. The techniques is tested on synthesized data for spheres. The technique is than applied to real images of known size to examine its use.

33212 (ANL/ET/CP–78557) **Fabrication and microstructural development of Ag-clad $TlBa_2Ca_2Cu_3O_x$ tapes.** Biondo, A.C.; Lanagan, M.T.; Goretta, K.C.; Hu, J.; Miller, D.J.; Wu, C.T.; Youngdahl, C.A.; Fisher, B.; Poeppel, R.B. Argonne National Lab., IL

(United States). Jul 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930703–8: International cryogenic engineering conference and international cryogenic materials conference, Albuquerque, NM (United States), 12-16 Jul 1993). Order Number DE93017407. Source: OSTI; NTIS; INIS; GPO Dep.

Three different 1223 powders with varied phase distributions were used to fabricate tapes by the powder-in-tube process. It was found that powders consisting primarily of phase pure 1223 were superior to a phase assemblage of Ca_2CuO_3, $BaCuO_2$, and Tl_2O_3 powders. No texturing in the microstructure was observed for any of the annealing times or temperatures. Critical current densities over 5,000A/cm^2 were measured at 77 K, and J_c degraded as the number of impurity phases increased. Further work will focus on other phase assemblages in the starting powder to determine if grain growth and alignment can be achieved in 1223.

33213 (ANL/ET/CP–78580) **Effects of hot-rolling on powder-in-tube BSCCO tapes.** Guo, J. (Univ. of Illinois, Urbana, IL (US). Dept of Nuclear Engineering); Schwartz, J.; Cha, Y.S.; Wu, C.T.; Goretta, K.C. Argonne National Lab., IL (United States). Jul 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930703–18: International cryogenic engineering conference and international cryogenic materials conference, Albuquerque, NM (United States), 12-16 Jul 1993). Order Number DE93018579. Source: OSTI; NTIS; GPO Dep.

High critical currents have been obtained in Bi-Sr-Ca-Cu-O by the powder-in-tube approach. Owing to the inherent structural anisotropy of the Bi-based high-Tc superconducting materials, high-Jc is only obtained when the wires are subsequently rolled into rectangularly cross-sectioned tapes. Previously, intermediate annealing was employed to maintain ductility in the silver with a high temperature sintering just before the final rolling in order to form the high-Tc superconducting phase. Here, the authors report on the effects of hot-rolling at various temperatures for the final rolling of powder-in-tube BSCCO-2212 tapes. Hot-rolling was accomplished by preheating the rolls with infrared heaters and rolling the tapes directly from the furnace. The highest current densities were obtained by final hot-rolling the 2212 tapes at 420°C with the furnace temperature of 750°C, the highest temperature studied. Results showed the enhancement of Jc was due to the improvement of grain alignment as well as the reduction of the size and fraction of Bi-free phases during the final heat treatment. Furthermore, an analytical model of the hot-rolling process has been developed that illustrates the importance of preheating the tapes and heating the rolls.

33214 (ANL/ET/CP–78942) **Sol-spray preparation, particulate characteristics, and sintering of alumina powders.** Varma, H.K. (Regional Research Lab., Trivandrum (India)); Mani, T.V.; Damodaran, A.D.; Warrier, K.G.K.; Balachandran, U. Argonne National Lab., IL (United States). Jul 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9308122–2: 3. international conference on advanced materials, Tokyo (Japan), 31 Aug - 4 sep 1993). Order Number DE93018577. Source: OSTI; NTIS; GPO Dep.

Fine alumina powders of spherical morphology and narrow particle-size distribution have been synthesized by a technique that uses precipitation/peptization/spray drying of boehmite sol prepared from aluminum nitrate. The spray-dried powder was further washed with solvents of varying polarities, such as acetone, isopropanol, and tert-butanol. This post-spray-drying treatment changed the powder's particle-size distribution, morphology, density, and compaction characteristics. Microstructure, dielectric properties, and effect of post-treatment on the boehmite-sol-derived alumina powders in reducing agglomeration are discussed.

33215 (ANL/MCT/CP–78646) **Fabrication, properties, and microstructures of high T_c tapes and coils made from Ag-clad Bi-2223 superconductors.** Balachandran, U. (Argonne National Lab., IL (United States)); Iyer, A.N.; Youngdahl, C.A.; Motowidlo, L.R.; Hoehn, J.G.; Haldar, P. Argonne National Lab., IL (United States). Jul 1993. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930703–7: International cryogenic engineering conference and international cryogenic materials conference, Albuquerque, NM (United States), 12-16 Jul 1993). Order Number DE93017405. Source: OSTI; NTIS; INIS; GPO Dep.

Bi-2223 precursor powders were prepared via a solid-state reaction using carbonates and oxides of Bi, Pb, Sr, Ca, and Cu. Results indicate that an in-situ reaction between constituent phases with tho formation of a transient liquid that is consumed during final heat treatment, is essential to obtain increased density with greater connectivity between the 2223 grains. Relative amounts of the constituent phases were adjusted in the powder by varying the calcination conditions, and the powder was then used to fabricate Ag-clad tapes by a powder-in-tube technique. By improving process conditions, transport critical current density (J_c) values greater than 4×10^4 A/cm^2 at 77 K and 2×10^5 A/cm^2 at 4.2 and 27 K have been obtained in short tape samples. Long tapes were cut into lengths upto 10 m long and used in parallel to fabricate small superconducting pancake coils. The coils were characterized at 77, 27 and 4.2 K and results are discussed.

33216 (ANL/MSD/CP–80258) **Photoemission studies of Zn, Co, and Gd substituted $YBa_2Cu_3O_{7-\delta}$.** Gu, Chun; Veal, B.W.; Liu, R. Argonne National Lab., IL (United States). Jun 1993. 9p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract W-31109-ENG-38. DMR 91-20000(CG);DMR 8601349. (CONF-930367–8: Conference on spectroscopies in novel superconductors, Santa Fe, NM (United States), 17-19 Mar 1993). Order Number DE93017403. Source: OSTI; NTIS; GPO Dep.

Zn and Co substitute for Cu in $YBa_2Cu_3O_{7-\delta}$ at the plane and chain sites, respectively. We report a high resolution angle-resolved photoemission study on Zn and Co substituted $YBa_2Cu_3O_{7-\delta}$ single crystals to determine the effects on electronic structure. The valence states near E_F along Γ-S are virtually unaffected by the substitutions for samples that are superconducting. However, the spectral weight near E_F disappears for a higher Co-doped, nonsuperconducting crystal. Results are compared with earlier studies on pure $YBa_2Cu_3O_{7-\delta}$ with controlled oxygen stoichiometry. Measurement on Gd-123 crystals with reduced oxygen stoichiometries show gradual reduction of spectral weight for a band along Γ-Y(X), in contrast to the results for the bands along Γ-S. The differences are probably due to a different admix of Cu-O chain and plane characters in these bands. We also measured Gd 4f resonance spectra which exhibit complex structure, indicating the presence of Gd atoms in chemically inequivalent (probably bulk and near surface) sites.

33217 (DOE/ER/13732–7) **Molecular and polymeric ceramic precursors: Progress report, December 1, 1990–November 30, 1993.** Sneddon, L.G. Pennsylvania Univ., Philadelphia, PA (United States). May 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-87ER13732. Order Number DE93040364. Source: OSTI; NTIS; GPO Dep.

The development of new methods for the production of complex materials is one of the most important problems in modern solid state chemistry and materials science. This project is attempting to apply the synthetic principles which have evolved in inorganic and organometallic chemistry to the production of technologically important non-oxide ceramics, such as boron nitride, boron carbide and metal borides. Our recent work has now resulted in the production of new polymer systems, including poly(B-vinylborazine), polyvinylpentaborane and polyborazylene, that have proven to be high yield precursors to boron-based ceramic materials. Current work s now directed toward the synthesis of new types of molecular and polymeric boron-containing species and an exploration of the solid state properties of the ceramics that have been produced in these studies.

33218 (INIS-mf–13548, pp. 109-111) **Radiation defects in irradiated gallium phosphide.** Volkov, V.V. (Kievskij Pedagogicheskij Inst., Kiev (Ukraine)); Opilat, V.Ya.; Tartachnik, V.P.; Tychina, I.I. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 9.* 225p. Order Number DE94600002. Source: OSTI; NTIS (US Sales Only); INIS.

The deep levels in neutron irradiated (E-bar=2 MeV) gallium phosphide were researched by the deep level transit spectroscopy

(DLTS) technique. The accordance between wide band in DLTS spectrum (E_a=0.2-0.7 eV) and fast neutrons created disordering regions in crystal was discovered. It is ascertained, that the destruction of disordered regions initiates upon heating to 400^{0}C. 8 refs.; 2 figs. (author).

33219 (INIS-mf–13548, pp. 166-172) **Electron irradiation effect on structural-phase state of superconducting niobium-carbon coatings.** Bakaj, A.S. (AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst.); Polyakov, Yu.I.; Sleptsov, A.N.; Sleptsov, S.N. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 9.* 225p. Order Number DE94600002. Source: OSTI; NTIS (US Sales Only); INIS.

Thorough studies of superconducting and phase parameters of structure - nonequilibrium coatings of NbC_{1-x} (x=0.3...0.98) were performed, and the effect of 8.8 MeV electron irradiation on this parameters, was investigated. It is found that in the ranges C<9 at.% and 15 at.%≤C≤20 at.% the temperature of superconducting transition is T_c=9.2 K and this T_c value increases for C=9...14 at.%. The irradiation produces no effect on T_c. The results obtained were discussed from the stand point of high-carbon phase NbC_{1-x} formation at the interface of the heterogeneous system Nb:c. 9 refs.; 4 figs.; 1 tab. (author).

33220 (INIS-mf–13548, pp. 173-179) **The observation of radiation-stimulated increase in critical temperature in HTSC-ceramics $YBa_2Cu_3O_{7-x}$.** Didenko, A.N. (Tomskij Politekhnicheskij Inst., Tomsk (Russian Federation)); Pokholkov, Yu.P.; Khasanov, O.L. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 9.* 225p. Order Number DE94600002. Source: OSTI; NTIS (US Sales Only); INIS.

The effect of γ-radiation ^{60}Co on the stability T_c in yttrium HTSC-ceramics has been studied. Samples prepared according a ceramic manufacturing technology from the charge of ultra dispersive powders have been investigated. The T_c was measured using an inductive method immediately after accumulating a dose as well as during several days after irradiation and parallel for control samples. Immediately T_c measurements, structure changes were measured using X-ray analysis and ultrasound acoustic, changes in defect concentration in HTSC electron subsystem - using positron diagnostics, the element composition - using RBS technique. The analysis of attained results shows the formation of metastable defects structure in a copper-oxygen HTSC sublattice. 8 refs.; 4 figs.; 2 tabs. (author).

33221 (INIS-mf–13548, pp. 180-185) **Anomalous shifts of oxygen ions in $YBa_2Cu_3O_{7-x}$ under irradiation.** Kirsanov, V.V. (Kalininskij Politekhnicheskij Inst., Kaliningrad (Russian Federation)); Musin, N.N. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 9.* 225p. Order Number DE94600002. Source: OSTI; NTIS (US Sales Only); INIS.

The behaviour of oxygen ions at propagation of ion-ion collision chains was considered. A model of crystallite in the form of rectangular parallelepiped was used for calculation. It was shown that implantation of additional oxygen ions in the crystallite leads to the increase of threshold energy shifts. 17 refs.; 2 figs. (author).

33222 (INIS-mf–13548, pp. 186-192) **The variations of high-Tc superconductors characteristics at irradiation by electrons and gamma rays.** Gatal'skij, G.V. (AN Belorusskoj SSR, Minsk (Belarus). Inst. Fiziki Tverdogo Tela i Poluprovodnikov); Gatal'skaya, V.I.; Korshunov, F.P.; Makarenko, L.F. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 9.* 225p. Order Number DE94600002. Source: OSTI; NTIS (US Sales Only); INIS.

Experimental results on the influence of gamma-rays ^{60}Co and fast electrons irradiation on high-T_c superconductors based on yttrium, bismuth and thallium are presented. Obtaining the single phase material is shown to be the crucial factor of rising the radiation induced degradation of the $YBa_2Cu_3O_y$ ceramic is established to be enhanced by its pre-exposure in moist air. In view of this fact the most promising materials for use in the ionising radiation environment are suggested to be compositions ones where the superconductor is protected from the direct contact with other surroundings. 5 refs.; 3 figs. (author).

33223 (INIS-mf–13548, pp. 193-196) **The influence of γ-irradiation on the superconducting properties of oxide $YBa_2Cu_3O_{7-x}$.** Krulikovskaya, M.P. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Fiziki); Moiseev, L.P.; Antonenko, R.S.; Muzalevskij, D.E.; Popovich, N.N.; Uvarova, S.K. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 9.* 225p. Order Number DE94600002. Source: OSTI; NTIS (US Sales Only); INIS.

The results of the investigation of an influence of the annealing by γ-irradiation on superconducting (SC) properties of oxide $YBa_2Cu_3O_{7-x}$ are presented. After annealing of the oxide the electrical resistance was measured in the temperature region 50-300 K. It is established that irradiation results in large degradation of oxide's properties. For fluence 2-3x10^{21} γ/m^2 the type of conductivity changes from metallic to semiconducting. It is shown that γ-irradiation leads to broadening of SC transition by 20 K. These phenomena are connected with the intensification of the oxygen diffusion from the oxide by γ-irradiation for 380^{0}C. 10 refs.; 2 figs. (author).

33224 (INIS-mf–13549, pp. 7-11) **The influence of ionizing radiation on optical properties of silica waveguides in temperature region 77-600 K.** Garkavenko, A.N. (Moskovskij Fiziko-Tekhnicheskij Inst., Moscow (Russian Federation)); Grushin, V.V.; Rodin, A.M. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 10.* 214p. Order Number DE94600067. Source: OSTI; NTIS (US Sales Only); INIS.

The results of investigation of induced absorption spectra of previously irradiated silica waveguides in 0.2-1.8 μm region for temperature range 77-600 K are presented. Measurements were performed for graded refractive index profile fibers with GeO_2-doped core and silica cladding. Fibers have been previously irradiated at room temperature using ^{60}Co, the absorbed dose range was 10^4-10^{8}rad. It was observed that the greatest variations of induced absorption vs temperature occurred in 0.3-1.0μm region with maximum at 380 nm and that temperature depended absorption for irradiated and unirradiated waveguides differs from each other. 7 refs.; 3 figs. (author).

33225 (INIS-mf–13549, pp. 41-49) **Study of electrophysical characteristics of electrochemical materials in the fields of intense radiation and elevated temperatures.** Neverov, V.A. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (Russian Federation)); Revyakin, Yu.L.; Kostyukov, N.S.; Antonova, N.P. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 10.* 214p. Order Number DE94600067. Source: OSTI; NTIS (US Sales Only); INIS.

Various electrophysical characteristics of ceramic materials in the fields of intense radiation fluxes (ϕ_H=4x10^{17} - 7x10^{18}m^{-2}xc^{-1}, P_γ=20-10^{3}Gyxs^{-1}) and elevated temperatures (250-600^{0}C) versus dose, intensity and spectral composition of radiation were studied. The electrophysical investigations showed that most electro ceramics conserved their performances through the significant radiation dose. 4 refs.; 3 figs.; 1 tab. (author).

33226 (INIS-RU–347, pp. 397) **Tantalum nitriding study by average energy proton nucleus backscattering.** Romanovskij,

E.A. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Goryaga, N.G.; Yarembash, I.E.; Myakinchenko, S.N.; Kuleba, E.L.; Dolgin, A.B. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. TANTALUM NITRIDES/backscattering; TANTALUM NITRIDES/diagnostic techniques; CONCENTRATION RATIO; CROSS SECTIONS; CRYSTALS; DEPTH; MEV RANGE 01-10; NITRIDATION; NITROGEN ADDITIONS; PROTON BEAMS; SOLID SOLUTIONS; SPATIAL DISTRIBUTION; TANTALUM; BACKSCATTERING

33227 (INIS-RU–347, pp. 405) **Analysis of depth profile of oxygen distribution in HTSC-films using nuclear reaction $^{16}O(d,\alpha)^{14}N$.** Dyumin, A.N. (AN SSSR, Leningrad (Russian Federation). Inst. Yadernoj Fiziki); Lebedev, V.M.; Luk'yanov, Yu.G.; Verbitskaya, E.M.; Eremin, V.K.; Konnikov, S.G.; Strokan, N.B. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. HIGH-TC SUPERCONDUCTORS/nuclear reaction analysis; SUPERCONDUCTING FILMS/oxygen; SUPERCONDUCTING FILMS/spatial distribution; ALPHA PARTICLES; DEPTH; DEUTERON REACTIONS; NITROGEN 14; OXYGEN 16 TARGET; OXYGEN

33228 (INIS-RU–352, pp. 20-22) **Modification of composition of HTSC polycrystalline films of YBaCuO system induced by constant current at 77 K.** Lubnin, E.N. (AN SSSR, Moscow (Russian Federation). Inst. Obshchej Fiziki); Mikhajlova, G.N.; Rudashevskij, E.G.; Prokhorov, A.M.; Seferov, A.S.; Sumarokov, V.N.; Tarasenkov, V.A.; Troitskij, A.V.; Chistov, A.G. AN SSSR, Moscow (Russian Federation). Fizicheskij Inst. 1991. (In Russian). In *Short communications on physics. Experimental and theoretical physics. No. 6.* 42p. Order Number DE94600073. Source: OSTI; NTIS (US Sales Only); INIS.

Changes in the composition of the high-temperature superconducting polycrystal films were studied. The $YBa_2Cu_3O_{7-\delta}$ films 10x2 mm in-dimensions and 2 μm thick produced by the condensate-diffusion method on polycrystal zirconium dioxide substrates were investigated. The films produced are highly homogeneous in composition, single-phase ones, have granular structure with grain size of 3-5 μm. The sample investigated was cooled upto 77 K. The 1 mA current was passed through the film during 575 h. The superconducting transition curve and VA characteristics were taken before and after current passage, the chemical composition was analyzed, the surface morphology was studied. The experiment has shown that mass transfer, which causes the substance composition modification in areas of current passage and leads to formation of nonsuperconductor phases, occurs as a result of current passage through the YBaCuO superconducting film at 77.4 K.

33229 (INIS-RU–352, pp. 30-32) **Investigation on the elastic properties of Gd-Sc-Al garnet by the Mandelstam-Brillouin light scattering method.** Zharikov, E.V.; Zagumennyj, A.I.; Kitaeva, V.F.; Lutts, G.B.; Terskov, D.B. AN SSSR, Moscow (Russian Federation). Fizicheskij Inst. 1991. (In Russian). In *Short communications on physics. Experimental and theoretical physics. No. 6.* 42p. Order Number DE94600073. Source: OSTI; NTIS (US Sales Only); INIS.

The Gd-Sc-Al garnet (GSAG) crystals grown from the melt with composition $Gd_{2.88}Sc_{1.89}Al_{3.23}O_{12}$, were investigated. The GSAG doped with chromium was also studied. The Mandelstam-Brillouin (MB) light scattering in the GSAG crystals was observed. The garnet elastic components were determined using the data on the MB component shifts, the products of the elastic constants by molar volume were calculated as well. The GSAG is elastically anisotropic. The doping addition introduction do not cause noticeable change in the elastic properties. The obtained values of elastic constants and their combinations for GSAG were compared with the data for aluminium and gallium garnets. The comparison has shown that the values of elastic constants for GSAG is closer to those for Gd-Sc-Ga garnet than to the corresponding values for the Y-Al one.

33230 (INIS-RU–353, pp. 12-14) **Heat conductivity of doped yttrium - scandium - gallium garnets within the temperature range of 6 to 300 K.** Zharikov, E.V. (AN SSSR, Moscow (Russian Federation). Inst. Obshchej Fiziki); Zavartsev, Yu.D.; Zagumennyj, A.I.; Lutts, G.B.; Studenikin, P.A.; Popov, P.A.; Sirota, N.N. AN SSSR, Moscow (Russian Federation). Fizicheskij Inst. 1991. (In Russian). In *Short communications on physics. Experimental and theoretical physics. No. 9.* 48p. Order Number DE94600071. Source: OSTI; NTIS (US Sales Only); INIS.

Four monocrystals of the yttrium - scandium - gallium garnets (YSGG), namely, the nominally pure, doped with Cr, doped with Nd and Cr and doped with Tb ones, were studied. The thermal conductivity measurement was made by the method of stationary heat flux. The error was not greater than 5% in the whole temperature range studied (6-300 K). It is shown that the different activating additions have sufficiently different influence upon the thermal conductivity of these crystals. The Tb ions have strong scattering influence upon the thermal conductivity. The Nd^{3+} ions affect the thermal conductivity weaker. The Cr ion presence leads to leveling-out of the curves of thermal conductivity as a function of temperature with its increase up to the room one, as compared with the nominally pure YSGG.

33231 (LA-UR–93-2693) **High energy resolution ARPES measurements of the normal and superconducting states of $Bi_2Sr_2CaCu_2O_{8+\delta}$.** Dessau, D.S. (Stanford Univ., CA (United States)); King, D.M.; Shen, Z.X. Los Alamos National Lab., NM (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract W-7405-ENG-36. Grant DMR8913478;DMR9121288. (CONF-930405–34: Spring meeting of the Materials Research Society, San Francisco, CA (United States), 12-16 Apr 1993). Order Number DE93018294. Source: OSTI; NTIS; GPO Dep.

The near-E_F electronic structure and Fermi surface of Bi2212 has been mapped out with ARPES. A key feature of our measured bandstructure is the existence of an extended region of flat CuO_2-derived bands at E_F. Comparative analysis of this data with that from NdCeCuO and $YBCO_7$ suggests that many of the anomalous (normal) physical properties of Bi2212 and $YBCO_7$ (NdCeCuO) may be related to the existence (absence) of such bands at E_F. Superconducting gap anisotropy at least an order of magnitude larger than that of the conventional superconductors has been observed in the a-b plane of Bi2212 in ARPES. For samples with $T_c$of 88K, the gap size reaches a maximum of approximately 20 MeV along the Cu-O bond direction, and a minimum of much smaller or vanishing magnitude 450 away. The experimental data is discussed within the context of various theoretical models. In particular, a detailed comparison with what is expected from a superconductor with a d_{x2-y2} order parameter is carried out, yielding a consistent picture.

33232 (LBL–34030) **Specific heat of $La_{1.875-x}Nd_xSr_{0.125}CuO_4$: Magnetic and structural transitions.** Wright, D.A. (Lawrence Berkeley Lab., CA (United States)); Fisher, R.A.; Phillips, N.E.; Crawford, M.K.; McCarron, E.M. III. Lawrence Berkeley Lab., CA (United States). May 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-930801–6: Conference of the International Union of Pure and Applied Physics on low temperature physics (LT 20), Eugene, OR (United States), 1-11 Aug 1993). Order Number DE93016978. Source: OSTI; NTIS; GPO Dep.

Near 70K $(La,Ba)_2CuO_4$ undergoes a structural transition from orthorhombic to tetragonal symmetry (LTO → LTT). Partial substitution of La by Nd produces an additional transition that has been

observed in structural studies. The specific heats of $La_{1.475}Nd_{0.4}Sr_{0.125}CuO_4$ and $La_{1.275}Nd_{0.6}Sr_{0.125}CuO_4$ samples exhibit anomalies near 75K, which are associated with these structural transitions, and additional smaller anomalies near 30K, which may be associated with a magnetic transition detected by μSR.

33233 (LBL–34189) **The microstructural mechanism of electromigration failure in narrow interconnects of Al alloys.** Kim, Choongun. Lawrence Berkeley Lab., CA (United States). Apr 1993. 203p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93018598. Source: OSTI; NTIS; GPO Dep.

This thesis reports a study of the mechanism of electromigration failure in Al-2Cu-1Si thin-film conducting lines on Si. Samples were patterned from 0.5 μm thick vapor-deposited films with various mean grain sizes (G), and had lines widths (W) of 1.3, 2, 4 and 6 μm. The lines were aged at various conditions to change the Cu-precipitate distribution and were tested to failure at T = 225°C and $j = 2.5 \times 10^6$ A/cm^2. Some samples were tested over a range of substrate temperatures, current densities and current reversal times. Aging produces an initially dense distribution of metastable Θ' (Al_2Cu; coherent) in the grain interiors, with stable Θ (Al_2Cu; incoherent) at the grain boundaries. The intragranular θ' is gradually absorbed into the grain boundary precipitates. In the wide lines the mean time to failure increases slowly and monotonically with pre-aging time and current reversal time. The failure mode is the formation and coalescence of voids that form on grain boundaries with an apparent activation energy of 0.65 eV. In the narrow lines, the lines failed by a transgranular-slit mechanism with an activation energy near 0.93 eV. The distribution of the polygranular segments and the kinetics of failure varies with the linewidths. Failure occurs after Cu has been swept from the grains that fail. Pre-aging the line to create a more stable distribution of Cu significantly increases the time to failure. When the density of intragranular Θ-phase precipitates is maximized, the transgranular-slit failure mechanism is suppressed, and the bamboo grain fails by diffuse thinning to rupture. The results from the current reversal test indicate that the time to sweep Cu in the polygranular segments is longer for longer polygranular segments. Thus the time to first failure in an array of lines is much longer than predicted by a log-normal fit to the distribution of failure times.

33234 (ORNL/FTR–4003) **Travel to Japan for the Third International Conference on Materials and Mechanisms of High-Temperature Superconductivity: Foreign trip report, July 19–31, 1991.** Christen, D.K. Oak Ridge National Lab., TN (United States). 16 Aug 1991. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93016413. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The traveler attended the Third International Conference on Materials and Mechanisms of High-Temperature Superconductivity, Kanazawa, Japan, and presented a contributed paper, "Effects of Thermal Processing and Oxygen Composition on Flux Pinning in High-J_c Epitaxial $Y_1Ba_2Cu_3O_{7-x}$ Thin Films." He also visited two superconductivity research laboratories.

33235 (ORNL/M–2881) **Survey of ceramic machining in Japan.** Bandyopadhyay, B.P. (North Dakota Univ., Grand Forks, ND (United States). Dept. of Mechanical Engineering); Blau, P.J. Oak Ridge National Lab., TN (United States). Jul 1993. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93018277. Source: OSTI; NTIS; GPO Dep.

This report is a compilation of four subcontract reports provided by B. P. Bandyopadhyay who, while a visiting professor at Toyohashi University in Japan, conducted a survey of ceramic machining technology in that country from January 1 through December 31, 1992. Various aspects of machining technology were surveyed: types of parts being produced, types of ceramic materials being used, the nature of current ceramic machining research and development, and types of machine tools. The four separate reports compiled here were originally provided in a narrative, chronological form, and some of the information has been reorganized into topical areas for this compilation. This report is organized into three sections: The first describes ten ceramic machining research and development organizations and provides a reference list of their current technical publications; the second, two major trade shows; and the third, several other products and commercial developments noted during the course of Bandyopadhyay's stay in Japan. An Appendix lists key individuals who are currently conducting ceramic machining research in Japan.

33236 (ORNL/Sub–90-SB047/2) **Analytical and experimental evaluation of joining silicon nitride to metal and silicon carbide to metal for advanced heat engine applications: Final report.** Kang, S. (GTE Labs., Inc., Waltham, MA (US)); Selverian, J.H.; O'Neil, D.; Kim, H.; Kim, K. Oak Ridge National Lab., TN (United States); GTE Labs., Inc., Waltham, MA (United States). May 1993. 169p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93018128. Source: OSTI; NTIS; GPO Dep.

This report summarizes the results of Phase 2 of Analytical and Experimental Evaluation of Joining Silicon Nitride to Metal and Silicon Carbide to Metal for Advanced Heat Engine Applications. A general methodology was developed to optimize the joint geometry and material systems for 650°C applications. Failure criteria were derived to predict the fracture of the braze and ceramic. Extensive finite element analyses (FEA) were performed to examine various joint geometries and to evaluate the affect of different interlayers on the residual stress state. Also, material systems composed of coating materials, interlayers, and braze alloys were developed for the program based on the chemical stability and strength of the joints during processing, and service. The FEA results were compared with experiments using two methods: (1) an idealized strength relationship of the ceramic, and (2) a probabilistic analysis of the ceramic strength (NASA CARES). The results showed that the measured strength of the joint reached 30–80% of the strength predicted by FEA. Also, potential high-temperature braze alloys were developed and evaluated for the high-temperature application of ceramic-metal joints. 38 tabs, 29 figs, 20 refs.

33237 **Method of producing amorphous thin films.** Brusasco, R.M. To Dept. of Energy. 1991. USA patent application 7-748,585. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93019330. Source: OSTI; NTIS; GPO Dep.

This invention dicloses a method for sintering particulate material (such as silica) with a laser beam to produce amorphous optical thin films on substrates.

33238 (SAND–92-1832) **Shock compression properties of silicon carbide.** Grady, D.E.; Kipp, M.E. Sandia National Labs., Albuquerque, NM (United States). Jul 1993. 47p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93019927. Source: OSTI; NTIS; GPO Dep.

An investigation of the shock compression and release properties of silicon carbide ceramic has been performed. A series of planar impact experiments has been completed in which stationary target discs of ceramic were struck by plates of either similar ceramic or other appropriate material at velocities up to 2.2 km/s with a propellant gun facility. The particle velocity history at the interface between the back of the target ceramic and a lithium-fluoride window material was measured with laser velocity interferometry (VISAR). Impact stresses achieved in these experiments range between about 10 and 50 GPa. Numerical solutions and analytic methods were used to determine the dynamic compression and release stress-strain behavior of the ceramic. Further analysis of the data was performed to determine dynamic strength and compressibility properties of silicon carbide.

33239 (SAND–93-0388C) **Impact strength and indentation hardness of high-strength ceramics.** Grady, D.E. Sandia National Labs., Albuquerque, NM (United States). [1993]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930676–27: 14. international conference of the International Association for the Advancement of High Pressure Science and Technology, Colorado Springs, CO (United States), 27 Jun - 2 jul 1993). Order Number DE93018833. Source: OSTI; NTIS; GPO Dep.

Hugoniot elastic limit and indentation hardness data are provided for selected high-strength ceramics AlN, Al_2O_3, B_4C, SiC, TiB, Zr_2.

Degree of correlation of the strength data by the two test methods is examined. Influence of reformation mechanism on strength measurement, including rate sensitivity, size scale and confining pressure, is discussed.

33240 (UCRL-JC–111591) **Superconductivity and magnetism in niobium doped $YBa_2Cu_3O_7$ related high-T_c ceramics.** Bennahmias, M. (Lawrence Livermore National Lab., CA (United States)); Radousky, H.B.; Goodwin, T.J.; Shelton, R.N. Lawrence Livermore National Lab., CA (United States). Feb 1993. 21p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract W-7405-ENG-48. Grant DMR-90-21029. (CONF-9302103–4: Annual meeting of the Minerals, Metals and Materials Society (TMS), Denver, CO (United States), 21-25 Feb 1993). Order Number DE93018086. Source: OSTI; NTIS; GPO Dep.

Magnetic characterization has been performed on the members of the cuprate-niobate $RBa_2Cu_2NbO_8$ (R = Pr, Nd, and La) series and $R_{1.5}Ce_{0.5}Sr_2Cu_2NbO_{10}$ (R = Pr, Eu, Nd, and Sm) series. The PrBCNO samples show a signature in the magnetization of a magnetic ordering at 12 K. The PrCSCNO sample is non-superconducting and shows two distinct orderings at 17 and 53 K. No such magnetic phase transition is observed down to 2 K in the Nd and La based RBCNO materials or the Nd, Sm, and Eu based RCSCNO materials. Measurements of the lower critical field curve, dc irreversibility line, and critical current densities are reported for each of the superconducting NdCSCNO, SmCSCNO, and EuCSCNO compounds.

3606 Other Materials

Refer also to citation(s) 32311, 32411, 32472, 32474, 32483, 32486, 32523, 32685, 32686, 32803, 32804, 33083, 33092, 33155, 33198, 33201, 33206, 33291, 33328, 33334, 33371, 33426, 33444, 33448, 33690, 33701, 34002, 34008, 34457, 34487, 34581, 34583, 34605

33241 (ANL/ET/CP–78558) **Mechanical properties of fiber-reinforced $YBa_2Cu_3O_x$ and $Bi_2Sr_2CaCu_2O_x$ bars.** Goretta, K.C. (Argonne National Lab., IL (United States)); Martin, L.J.; Singh, D.; Poeppel, R.B.; Chen, Nan; Chu, C.Y.; Routbort, J.C.; Gleixner, R.A. Argonne National Lab., IL (United States). Jul 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930703–10: International cryogenic engineering conference and international cryogenic materials conference, Albuquerque, NM (United States), 12-16 Jul 1993). Order Number DE93017689. Source: OSTI; NTIS; GPO Dep.

Strength in four-point bending and fracture toughness of $YBa_2Cu_3O_x$ (123) and $Bi_2Sr_2CaCu_2O_x$ (2212) were examined at room temperature. The 123 was reinforced with 15 vol.% Y_2BaCuO_5 (211) fibers and was processed to 90–91% density by cold pressing and sintering. The 2212 was reinforced with 15 vol.% 2212 fibers and was processed to ≈90% density by sinter forging. The 123/211 composites had a fracture toughness of 1.9 $MPa(m)^{0.5}$, which is 20–30% higher than that of corresponding monoliths, but exhibited no improvement in strength. The strength and fracture toughness of the 2212/2212 composites were 102 MPa and 2.7 $MPa(m)^{0.5}$, respectively, which were slight improvements over the monoliths. Transport critical current densities at 77 K were only slightly affected by the fiber additions.

33242 (ANL/ET/CP–78721) **Thermal wave image processing for characterization of subsurface of flaws in materials.** Gopalan, K. (Purdue Univ. Calumet, Hammond, IN (US). Dept. of Engineering); Gopalsami, N. Argonne National Lab., IL (United States). [1993]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930854–1: 36. Midwest symposium on circuits and systems, Detroit, MI (United States), 16-18 Aug 1993). Order Number DE93019024. Source: OSTI; NTIS; GPO Dep.

Infrared images resulting from back-scattered thermal waves in composite materials are corrupted by instrument noise and sample heat-spread function. This paper demonstrates that homomorphic deconvolution and "demultiplication" result in enhanced image quality for characterization of subsurface flaws in Kevlar and graphics composites. The choice of processing depends on the material characteristics and the extent of noise in the original image.

33243 (ANL/MSD/CP–79845) **Nanostructured materials: Mind over matter.** Siegel, R.W. Argonne National Lab., IL (United States). May 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920947–6: Conference on nanostructured materials, Cancun (Mexico), 21-25 Sep 1992). Order Number DE93017690. Source: OSTI; NTIS; GPO Dep.

Considerable interest is being exhibited in novel, enhanced properties of nanostructured materials. These materials, with constituent phase or grain structures modulated on a length scale less than 100 mn, are now artificially synthesized by a wide variety of physical, chemical, and mechanical methods. Nanostructured material, with modulation dimensionalities of zero (clusters), one (multilayers), two (ultrafine-grained overlayers), and three (nanophase materials) are considered. The basic principles involved in synthesis of these new materials are discussed in terms of the special properties sought using selected examples from particular synthesis and processing methodologies. Some examples of property changes that can result from one of these methods, cluster assembly of nanophase materials, are presented.

33244 (ANL/MSD/CP–80248) **Elastic properties of a polyimide film determined by Brillouin scattering and mechanical techniques.** Kumar, R.S. (Amoco Chemical Co., Naperville, IL (United States). Research and Development Dept.); Schuller, I.K.; Kumar, S.S.; Fartash, A.; Grimsditch, M. Argonne National Lab., IL (United States). Jun 1993. 8p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract W-31109-ENG-38. Grant N00014-91j-1438. (CONF-930405–31: Spring meeting of the Materials Research Society, San Francisco, CA (United States), 12-16 Apr 1993). Order Number DE93017404. Source: OSTI; NTIS; GPO Dep.

We discuss here the complete determination of the elastic properties of a polyimide film using two experimental techniques. One technique employs the polymer film as a vibrating membrane and allows a direct determination of the "macroscopic" biaxial modulus. Brillouin scattering, which measures the elastic properties on a ∼ 100μ scale, allows for a complete characterization of the elastic behavior. Results obtained by the two techniques are in agreement within reported error bars.

33245 (ANL/RE–93/7) **Dynamic characteristics of Bridgestone low shear modulus-high damping seismic isolation bearings.** Chang, Y.W.; Seidensticker, R.W. Argonne National Lab., IL (United States). Jun 1993. 72p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93040384. Source: OSTI; NTIS; INIS; GPO Dep.

Bridgestone Company of Japan is one of the leading seismic bearing manufacturers in the world. Their bearings have very good performance records. It appears that Bridgestone's high damping bearings are made of a blend of filled natural and synthetic rubbers with fillers and plastizers whereas in the United States, the high damping compound is a carbon filled natural rubber. To compare the properties of the two different kinds of high damping compounds, Argonne National Laboratory (ANL) purchased eight bearings from Bridgestone: four of which were made of high shear modulus-high damping rubber compound KL401; the other four were made of low shear modulus-high damping rubber compounds: two with KL301 elastomer and two with KL302 elastomer. Tests of the Bridgestone bearings were performed at the Earthquake Engineering Research Center. The dynamic characteristics of the high shear modulus Bridgestone bearings, KL401, are described in ANL/Shimizu Report ANL-003. This report describes the dynamic and failure characteristics of the low shear modulus Bridgestone bearings, KL301 and KL302.

33246 (BNL–49092) **Phase transitions and neutron scattering.** Shirane, G. Brookhaven National Lab., Upton, NY (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9303190–3: International symposium on advanced nuclear energy research - neutrons as microscopic probes, Mito Ibaraki (Japan),

10-12 Mar 1993). Order Number DE93016748. Source: OSTI; NTIS; INIS; GPO Dep.

A review is given of recent advances in neutron scattering studies of solid state physics. The author has selected the study of a structural phase transition as the best example to demonstrate the power of neutron scattering techniques. Since energy analysis is relatively easy, the dynamical aspects of a transition can be elucidated by the neutron probe. He will discuss in some detail current experiments on the 100K transition in $SrTiO_3$, the crystal which has been the paradigm of neutron studies of phase transitions for many years. This new experiment attempts to clarify the relation between the neutron central peak, observed in energy scans, and the two length scales observed in recent x-ray diffraction studies where only scans in momentum space are possible.

33247 (BNL–49345) **Outgassing rate of Reemay Spunbonded Polyester and DuPont Double Aluminized Mylar.** Todd, R.J.; Pate, D.; Welch, K.M. Brookhaven National Lab., Upton, NY (United States). Aug 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE93040015. Source: OSTI; NTIS; GPO Dep.

This paper presents the outgassing rates of two commercially available multi-layer insulation (MLI) materials commonly used in cryogenic applications. Both Reemay Spunbonded Polyester and DuPont Double Aluminized Mylar (DAM) were studied for outgassing species and respective rates, and the total amount of outgassed material. Measurements were made using a Fixed Aperture Technique. A sample was pumped on through an aperture of known size with a turbomolecular pump. Pressure vs. time was plotted for both Reemay and DAM, as well as the baseline system, and data conveniently extrapolated to ≈1,000 hrs. A quadrupole residual gas analyzer was used to measure the outgassing species.

33248 (CONF-9304144–11) **Growth of epitaxial semiconductor alloys and superlattices with continuously variable composition by pulsed-laser ablation.** McCamy, J.W. (Tennessee Univ., Knoxville, TN (United States). Dept. of Materials Science); Lowndes, D.H. Oak Ridge National Lab., TN (United States). [1993]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 2. international conference on laser ablation: mechanisms and applications; Knoxville, TN (United States); 19-22 Apr 1993. Order Number DE93018726. Source: OSTI; NTIS; GPO Dep.

We describe a new method to grow epitaxial semiconductor alloys with continuously variable composition, while using a single pulsed laser ablation target of fixed composition. Epitaxial $ZnSe_{1-x}S_x$ films with continuously variable sulfur content "x" were grown by ablating a ZnSe target through low-pressure ambient H_2S gas. The sulfur content was easily controlled by varying the H_2S partial pressure. The composition of $ZnSe_{1-x}S_x$ films differs by as much as x = 0.52 from the pure ZnSe target. We have used this method to grow heteroepitaxial structures with either continuously graded or periodically repeating, abrupt compositional changes (compositional superlattices). Structures that simultaneously incorporate both types of compositional modulation also have been grown. This development removes the principal barrier to convenient pulsed-laser ablation (PLA) growth of compositionally graded semiconductor thin-film materials, namely that the film and target normally have the same composition. The method appears to have broad application for PLA growth of other compound semiconductor films and heterostructures, as well as for doping individual layers.

33249 (DOE/CE/23810–13-Vol.1) **Compatibility of refrigerants and lubricants with motor materials: Volume 1, Final report.** Doerr, R.; Kujak, S. Trane Co., La Crosse, WI (United States). May 1993. 154p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91CE23810. Order Number DE93040216. Source: OSTI; NTIS; GPO Dep.

This volume contains the abstract, scope, discussion of results, charts of motor material compatibility, test procedures, material identifications, and 84 pages of data summary tables. Compatibility test results for 11 pure refrigerants and 17 refrigerant-lubricant combinations with 24 motor materials are included. The greatest effect on the motor materials was caused by adsorption followed by desorption of refrigerants at higher temperatures. High internal pressure of the adsorbed refrigerants and their tendency to evolve from the materials resulted in blisters, cracks, internal bubbles in the varnish, and delamination or bubbles in the sheet insulations. The second effect was extraction or dissolution of materials that lead to embrittlement of some sheet insulations. HCFC-22 and HCFC- 22/mineral oil had the most deleterious effects; the materials are expected to be reliable when used with most of the new refrigerants and lubricants. Tables.

33250 (DOE/CE/23810–13-Vol.2) **Compatibility of refrigerants and lubricants with motor materials: Volume 2, Effects of refrigerant exposures on motor materials.** Doerr, R.; Kujak, S. Trane Co., La Crosse, WI (United States). May 1993. 254p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91CE23810. Order Number DE93040217. Source: OSTI; NTIS; GPO Dep.

This volume contains all the recorded measurements from the tests on the motor materials after exposures to the 11 pure refrigerants and to nitrogen at 60, 90, and 121 C. Tables.

33251 (DOE/CE/23810–13-Vol.3) **Compatibility of refrigerants and lubricants with motor materials: Volume 3, Effects of refrigerant-lubricant exposures on motor materials.** Doerr, R.; Kujak, S. Trane Co., La Crosse, WI (United States). May 1993. 349p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91CE23810. Order Number DE93040218. Source: OSTI; NTIS; GPO Dep.

This volume contains all the recorded measurements from the tests on the motor materials after exposure to the 17 refrigerant-lubricants combinations and to nitrogen at 126 or 127 C.

33252 (DOE/CE/23810–16) **Thermophysical properties: Progress report, 1 January 1992–31 March 1993.** Kayser, R.F. National Inst. of Standards and Technology, Gaithersburg, MD (United States). Thermophysics Div. Apr 1993. 237p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91CE23810. Order Number DE93040219. Source: OSTI; NTIS; GPO Dep.

Numerous fluids have been identified as promising alternative refrigerants, but much of the information needed to predict their behavior as pure fluids and as components in mixtures does not exist. In particular, reliable thermophysical properties data and models are needed to predict the performance of the new refrigerants in heating and cooling equipment and to design and optimize equipment to be reliable and energy efficient. The objective of this fifteen-month project has been to provide highly accurate, selected thermophysical properties data for Refrigerants 32, 123, 124, and 125, and to use these data to fit equations of state and transport property models. The new data have filled gaps in the existing data sets and resolved problems and uncertainties that existed in and between the data sets.

33253 (DOE/ER/13433–5) **Substrate temperature measurement and control during thermal plasma CVD.** Zhuang, Q.D.; Guo, H.; Han, Q.Y.; Heberlein, J.V.R.; Pfender, E. Minnesota Univ., Minneapolis, MN (United States). Dept. of Mechanical Engineering. [1993]. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-85ER13433. Order Number DE93040305. Source: OSTI; NTIS; GPO Dep.

A technique is proposed for substrate temperature control, with emphasis on temperature uniformity across substrate. The technique includes a substrate holder design employing non-uniform water cooling and a means of substrate attachment featured by controlled thermal contact resistance for a given heat flux distribution from the plasma. The technique was applied to deposit diamond films over a 5 cm diameter area in a DC thermal plasma reactor, and proved adequate. Performance of single-color (0.655 μm) and two-color (2.1 and 2.4 μm) pyrometers were evaluated against DC thermo.] plasma radiation. It was found that both line and continuum emission of plasma jets caused large errors in temperature measurement of the single-color pyrometer. The two-color pyrometer, however, is shown to be less sensitive to the plasma radiation. The way the substrate temperature was controlled and monitored in this study is in general applicable to other TPCVD processes where intense local heating and a bright plasma background exist.

33254 (DOE/ER/45283–12) **[X-ray studies of microstructures in semiconductor and superconducting materials]: Performance report.** Kao, Y.H. State Univ. of New York, Buffalo, NY (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-87ER45283. Order Number DE93040690. Source: OSTI; NTIS; GPO Dep.

A summary of research work performed from 11/1/86 to 4/10/93 is presented. Synchrotron x rays were used to probe the short-range-order (SRO) structures in these materials, especially layered semiconductors and high-$T_c$oxide superconductors. X-ray absorption fine structure spectroscopy, grazing incidence x-ray scattering and fluorescence, and total electron yield as probe for surfaces and interfaces were used. A new soft x-ray detector was developed.

33255 (DOE/ER/45460–2) **The effects of moisture on the microstructure of cement-based materials: Progress report.** Jennings, H.M. Northwestern Univ., Evanston, IL (United States). 15 Jul 1993. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER45460. Order Number DE93019854. Source: OSTI; NTIS; GPO Dep.

New information about shrinkage at the microstructural level has been acquired. Experiments and computer analysis serve as a basis for modeling. Some highlights: C-S-H (shrinking phase) shrinks and values for dimensional change are being determined. There may be two types of C-S-H, only one of which shrinks. All other phases serve as restraints to shrinkage. Pores expand on drying and therefore may be a mechanism for the "size effect", in addition to microcracks.

33256 (DOE/FTR–93014687) **Travel to Japan for conference on high pressure in semiconductor physics: Foreign trip report, August 13–24, 1992.** Samara, G.A. Sandia National Labs., Albuquerque, NM (United States). [1992]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93014687. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The Kyoto Conference was a relatively small international conference which brought together 124 experts from 8 countries to discuss the latest developments in the use of high pressure in semiconductor physics. Significant theoretical and experimental advances were reported in the areas of band structure, band offsets, superlattices and other quantum well structures, defects and deep electronic levels, phase transitions, stability of strained layers and new experimental techniques. The Post Conference Workshop covered some of the same topics as the Conference, but allowed more time for discussion. The visits to the two main campuses of the Tokyo Institute of Technology offered an excellent opportunity to learn about ongoing leading research in ceramics, ceramic thin films, superhard materials, high $T_c$super conductors and ferroelectric clusters.

33257 (DOE/FTR–93017322) **Travel to India to attend and present an invited lecture at the 8th annual meeting of the Polymer Processing Society: Foreign trip report, March 21–April 8, 1992.** Clough, R.L. Sandia National Labs., Albuquerque, NM (United States). 7 May 1992. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93017322. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report highlights technical information obtained during attendance at an international conference of the Polymer Processing Society and at three site visits. It also provides an evaluation of the nature and quality of research work underway at the institutions visited. The Polymer Processing Society is an international technical organization which focuses on molding, forming, casting, blending, and process control in the manufacture of polymeric materials. PPS conference presentations on advanced lithographic materials and on new radiation-curing techniques for epoxy composites were particularly valuable for Sandia programs. Other important lectures described advances in the processing of polymer blends, and development of environmentally-friendly polymers and processes. The Indian Institute of Technology (IIT) in New Delhi, which is considered to be the leading scientific university in India, has a considerable involvement in polymer science - particularly in molding technology and composite materials. The Bhabha Atomic Research Center has extensive research programs in radiation processing and radiation chemistry, including many fundamental research programs.

33258 (ENEA-RT-INN–92-22) **Synchroton radiation photoemission analysis of ArF laser deposited tin oxide.** Larciprete, R. (ENEA, Frascati (Italy). Centro Ricerche Energia - Area Energia e Innovazione); Borsella, E.; De Padova, P.; Mangiantini, M.; Perfetti, P.; Fanfoni, M. Dec 1992. 21p. (RT/INN–92-22). Order Number DE93522942. Source: OSTI; NTIS (US Sales Only).

The photolysis at 193 nm of tetramethyltin (TMT) diluted in oxygen was exploited to deposit tin oxide films on Si substrates. The 'in situ' Auger analysis showed that the oxygen concentration in the gas phase mixture played a relevant role in removing organic contamination and increasing the [O]/[Sn] ratio in the films; therefore, the condition for the achievement of C free tin oxide films were identified. The electronic properties of this material were investigated by synchrotron radiation UV photoemission spectroscopy (UPS). With this aim, a typical tin oxide sample was transferred to a synchrotron radiation facility kept in a dynamic high vacuum condition in order to limit the contamination of the surface. The valence band UPS spectrum showed characteristic SnO_2 features, and the analysis of the 4d Sn core levels demonstrated that all metal atoms were oxidized, since no contribution to the peak shape due to metallic tin was found. However the weak emission from the band gap region, which indicates the presence of oxygen vacancies, suggested that the surface was made up also by a SnO-like component and resulted therefore, on the whole, to be sub-stoichiometric.

33259 (ETDE-IT–93-199) **Multiphoton dissociation of zinc dialkyls probed by resonance enhanced multiphoton ionization.** Borsella, E. (ENEA, Frascati (Italy)); Larciprete, R.; Nesterenko, A.; Akulin, V.M. 1993. 16p. Order Number DE93523004. Source: OSTI; NTIS (US Sales Only).

The production of zinc atoms in the multi-photon dissociation of zinc dialkyls Zn $(CH_3)_2$ (DMZ) and Zn $(C_2H_5)_2$ (DEZ)) is probed by the resonance enhanced multi-photon ionization (REMPI) technique. Asymmetric power-dependent broadening of resonant line profiles is observed. The dependence of resonant zinc ion yield is analyzed as a function of wavelength and intensity of laser field. Evidence is obtained that the dissociative production of ground state zinc atoms is suppressed with the increase of laser intensity.

33260 (INIS-mf–13548, pp. 123-130) **Optical spectroscopic studies of electron-irradiated GaP crystals.** Brodin, M.S. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Fiziki); Goer, D.B.; Kolb, A.A.; Malesh, V.G.; Megela, I.G. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 9.* 225p. Order Number DE94600002. Source: OSTI; NTIS (US Sales Only); INIS.

Processes of formation and annealing of radiation defects in GaP under electron irradiation are studied by optical absorption, photoluminescence and Raman spectroscopic techniques. A considerable part of optically revealed defects, being introduced by the irradiation at 77 K, is shown to be removed by annealing to 300 K. A substantial disordering of the crystal lattice is concluded to be caused by multi defect complexes. 17 refs.; 5 figs. (author).

33261 (INIS-mf–13548, pp. 131-137) **Particularities of electro-physical properties at annealing of high purity silicon doped by neutron transmutation.** Semenyuk, A.K. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Litovchenko, P.G.; Voevoda, G.P.; Lastovetskij, V.F. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 9.* 225p. Order Number DE94600002. Source: OSTI; NTIS (US Sales Only); INIS.

Changes of electric and recombination parameters in initial and doped by neutron transmutation p-Si crystals with high resistance were studied. Concentration of oxygen, carbon, boron, phosphorus was determined separately at isochronous annealing in temperature range 100...1200^{0}C. 9 refs.; 2 figs.; 1 tab. (author).

33262 (INIS-mf–13548, pp. 142-146) **Dynamics of radiation damage accumulation in quartz at light ion irradiation.** Kalantar'yan, O.V. (Khar'kovskij Gosudarstvennyj Univ., Kharkov (Ukraine)); Kononenko, S.I.; Muratov, V.I. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 9.* 225p. Order Number DE94600002. Source: OSTI; NTIS (US Sales Only); INIS.

The dynamics of defect accumulation in quartz glass at bombarding by helium and hydrogen ions was studied. Influence of hydrogen on radiation-optical stability of quartz was investigated by optical spectroscopy of sample ion luminescence. 4 refs.; 3 figs. (author).

33263 (INIS-mf–13549, pp. 3-6) **Radiation stimulated conductivity and the electrization of electrical insulating materials in the field of intense pulsed electron radiation.** Solov'ev, Yu.A. (Tomskij Politekhnicheskij Inst., Tomsk (Russian Federation)); Sorokin, S.B. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 10.* 214p. Order Number DE94600067. Source: OSTI; NTIS (US Sales Only); INIS.

The paper deals with the experimental investigation of radiation-induced conductivity and the electrization of high impedance dielectrics irradiated by electron pulses of 50 ns duration with 1 MeV energy and the current density of the order 1kA/cm^2, dose $\approx 10^{13}$ Gr/s. It has been found that the dependence of radiation-induced conductivity on the dose power is close to a linear one under studied conditions. Certain materials effectively accumulate the space charge up to spontaneous breakdown in the charge field. 5 refs.; 3 figs. (author).

33264 (INIS-mf–13549, pp. 12-14) **Radiation-stimulated diffusion in thin films of chalcogenide glasses.** Gusak, N.V. (Moskovskij Fiziko-Tekhnicheskij Inst., Moscow (Russian Federation)); Litinskaya, L.I. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 10.* 214p. Order Number DE94600067. Source: OSTI; NTIS (US Sales Only); INIS.

Changes in chemical composition of As-S films at high energy electron irradiation have been investigated. It has been revealed that there were no changes in concentration profile up to the dose $5x10^{13}cm^{-2}$, but the electron irradiation in the range of $1x10^{14}cm^{-2}$-$3x10^{16}cm^{-2}$ (as the laser one with wavelength 0,51μm) causes a nonmonotonic change of C_{AS}/C_S concentration ratio, the surface layer being rich in As atoms. Authors suppose, that at the doses more that $1x10^{15}cm^{-2}$ there is transition to "radiation" type of the interaction of electrons with the matter. 3 refs.; 1 fig. (author).

33265 (INIS-mf–13549, pp. 32-40) **Insulators investigations during long thermo radiation aging.** Neverov, V.A. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (Russian Federation)); Vitkovskij, I.V.; Revyakin, Yu.L.; Karasev, B.G.; Kirillov, I.R. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 10.* 214p. Order Number DE94600067. Source: OSTI; NTIS (US Sales Only); INIS.

Electric strength and conductivity of different electro insulating compositions exposed to elevated temperature and ionizing radiations were investigated. Radiation-stimulated thermo-aging was carried out for various sample batches at (410+10)^{0}C and with the relatively low density of neutron (ϕ_n=10^{12}-$10^{13}m^{-2}s^{-1}$) and γ-radiation ($\pi_\gamma \leq 0.01$ Grxs^{-1}) fluxes up to different doses. Maximum operating age was 23870 hs. 6 refs.; 4 figs.; 1 tabs. (author).

33266 (INIS-mf–13549, pp. 53-60) **Defect formation stimulated by electronic subsystem excitation of atomic cryo crystals.** Grigorashchenko, O.N. (AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. Nizkikh Temperatur); Ogurtsov, A.N.; Savchenko, E.V.; Fugol', I.Ya. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 10.* 214p. Order Number DE94600067. Source: OSTI; NTIS (US Sales Only); INIS.

The experiments are described in which a new mechanism of radiation-stimulated defect formation in the atomic cryo crystals is detected by means of luminescent spectroscopy. The essence of this mechanism is the transformation of electronic subsystem excitation energy into kinetic energy of lattice atoms. Its distinctive feature is the defect formation at the stage of electronic excitation trapping which precedes radiative annihilation. The defect formation is found which is stimulated by excitation localization at centers of atomic and molecular type. 7 refs.; 4 figs.; 1 tab. (author).

33267 (INIS-mf–13549, pp. 61-66) **Effect of electron irradiation on the structure and properties inorganic materials during radiating synthesis.** Zelenskij, V.F. (AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst.); Neklyudov, I.M.; Shevyakova, Eh.P.; Lifshits, E.V. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 10.* 214p. Order Number DE94600067. Source: OSTI; NTIS (US Sales Only); INIS.

The electron irradiation influence on the stoichiometry, disordering the crystalline structure, the rate of the interaction in synthesis and phase transformation in the inorganic materials has been investigated. It was determined influence of irradiation on the infrared absorption spectrum, crystal optics and X-ray diffractions of the oxides, spinels and high-temperature superconductors (HTS). In these conditions synthesis of silicates, spinels, HTS materials and the phase transformation of $YBa_2Cu_3O_{7-\delta}$ compound to superconductor $YBa_2Cu_3O_{7-\delta}$ results in decreasing temperature compared with sintering in the furnace (near 200-300). 12 refs.; 3 figs. (author).

33268 (INIS-mf–13549, pp. 78-85) **Defects and structure transformations of neutron irradiated boron nitride.** Buzhinskij, O.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (Russian Federation). Inst. Atomnoj Ehnergii); Kabyshev, A.V.; Lopatin, V.V.; Surov, Yu.P. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 10.* 214p. Order Number DE94600067. Source: OSTI; NTIS (US Sales Only); INIS.

Pyrolytic boron nitride irradiated by neutrons of fission reactor has been studied. Their fluences are $1.4x10^{19}$ - $1.3x10^{24}m^{-2}$. Electron-positron annihilation and EPR methods were used to identify defects in graphite-like boron-nitride crystallites. Two stages isochronal annealing were observed in the temperature range (20-1730)^{0}C: 1) annealing of two-nitrogen centers to 1300^{0}C and 2) increasing concentration of three-boron centers. Structural transformations of irradiated pyrolytic boron nitride indicate decreasing concentration of 3-D-coordinated crystallites with conserved mutual orientation in basal planes. 9 refs.; 4 figs. (author).

33269 (INIS-mf–13549, pp. 122-125) **Development of methodics and investigation of spheric elements high-temperature oxidation in radiation fields.** Kamenev, A.S. (AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst.); Odejchuk, N.P. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 10.* 214p. Order Number DE94600067. Source: OSTI; NTIS (US Sales Only); INIS.

A methodics for investigation of radiation-stimulated high-temperature oxidation of spheric elements and high-temperature gas cooled reactor (HTGR) construction materials in air flow was elaborated. Operation parameters of spheric elements in non-regular HTGR operation were studied. 4 refs.; 2 figs.

33270 (INIS-RU–347, pp. 449) **Study of long-lived charge exchange of carbon foils.** Kozeratskaya, G.N.; Mashkarov, Yu.G.; Ostranitsa, A.P.; Shvedov, A.T. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. 1 tab. CARBON/lifetime; CARBON/targets; AMORPHOUS STATE; CARBON; LIFETIME; TARGETS; CARBON 12 BEAMS; FOILS; HELIUM 4 BEAMS; MEV RANGE 01-10; NITROGEN 14 BEAMS; PROTON BEAMS; RADIATION DOSES; THICKNESS; VAPOR DEPOSITED COATINGS

33271 (IS-M–747) **A numerical analysis of crack growth in brittle microcracking composites.** Biner, S.B. Ames Lab., IA (United States). [1993]. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-82. (CONF-931078–1: Mechanism and mechanics of composite fracture meeting, Pittsburgh, PA (United States), 17-21 Oct 1993). Order Number DE93011562. Source: OSTI; NTIS; INIS; GPO Dep.

A set of numerical analyses of crack growth was performed to elucidate the mechanism of microcracking on the observed fracture behavior of brittle solids and composites. The random nucleation, orientation and size effects of discrete microcracks and resulting interactions are fully accounted for in a hybrid finite element model. The results indicate that the energy expenditure due the microcrack nucleation seems not to contribute significantly to the resistance to crack growth. The main controlling parameter appears to be elastic interaction of the microcracks with the main crack in the absence of a reinforcing phase; therefore, the microcrack density plays an important role. In the case of the composites, the interaction of the main crack with the stress fields of the reinforcing phase, rather than interaction of microcracks, is the controlling parameter for the resistance to the crack growth even in the presence of a large population of microcracks. It will be also shown that the crack branching and crack kinking can readily develop as a result of microcracking.

33272 (KCP–613-5111) **Cratering evaluations and results.** Church, J.R. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Aug 1993. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. Order Number DE93040347. Source: OSTI; NTIS; GPO Dep.

Investigations were performed on the 1-mil ultrasonic aluminum wire bonding process to determine how the interaction of the bonding parameters, ultrasonic power, time, force, and aluminum wire, contribute to cratering (cracking or damage to oxide/passivation layers). Investigations revealed that power, time, and force can interact at levels which can contribute to cratering. The age of the aluminum wire can also influence the quality of bonds.

33273 (LA–12569) **Calculation of the LiF-CeF_3-BeF_2 and LiF-PuF_3-BeF_2 ternary phase diagrams.** Mulford, R.N.R. Los Alamos National Lab., NM (United States). Jul 1993. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93017437. Source: OSTI; NTIS; INIS; GPO Dep.

The LiF-CeF_3-BeF_2 and LiF-PuF_3-BeF_2 ternary phase diagrams were calculated from optimized binary diagrams using computer programs developed by Lukas and coworkers. The approximate overall diagrams were calculated without the use of ternary interaction terms, but inclusion of ternary terms was necessary to reproduce the experimental data for solubilities of CeF_3 and PuF_3 which are considerably less soluble in LiF-BeF_2 liquid than predicted without ternary interaction terms.

33274 (LA-UR–93-2291) **Shock-loading response of advanced materials.** Gray, G.T. III. Los Alamos National Lab., NM (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930676–16: 14. international conference of the International Association for the Advancement of High Pressure Science and Technology, Colorado Springs, CO (United States), 27 Jun - 2 jul 1993). Order Number DE93018344. Source: OSTI; NTIS; GPO Dep.

Advanced materials, such as composites (metal, ceramic, or polymer-matrix), intermetallics, foams (metallic or polymeric-based), laminated materials, and nanostructured materials are receiving increasing attention because their properties can be custom tailored specific applications. The high-rate/impact response of advanced materials is relevant to a broad range of service environments such as the crashworthiness of civilian/military vehicles, foreign-object-damage in aerospace, and light-weight armor. Increased utilization of these material classes under dynamic loading conditions requires an understanding of the relationship between high-rate/shock-wave response as a function of microstructure if we are to develop models to predict material behavior. In this paper the issues relevant to defect generation, storage, and the underlying physical basis needed in predictive models for several advanced materials will be reviewed.

33275 (LA-UR–93-2690) **Pressure induced metallization of the Mott insulator VI_2.** Sterer, E. (Tel Aviv Univ. (Israel)); Pasternak, M.P.; Taylor, R.D. Los Alamos National Lab., NM (United States). 20 Jul 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930676–31: 14. international conference of the International Association for the Advancement of High Pressure Science and Technology, Colorado Springs, CO (United States), 27 Jun - 2 jul 1993). Order Number DE93018296. Source: OSTI; NTIS; INIS; GPO Dep.

Using diamond anvil cells, ^{129}I Moessbauer spectroscopy (MS) and resistivity measurements were carried out in the layered antiferromagnet VI_2 at 0-45 GPa and 4-300 K. MS to 15 GPa revealed an impressive increase in Neel temperature and a slight increase in transferred hyperfine field. Pressure behavior of R(P,T), in particular near the metal-insulator pressure P_c=44 GPa, is described. Being the lightest transition metal (TM) in the isostructural (TM)I_2 series, the V^{2+} (d^3 configuration) represents a typical candidate for a pure Mott-Hubbard gap closure. Results are compared with the heavy TM diiodides such as NiI_2 and CoI_2, where it is expected that the charge transfer regime prevails. 3 figs, 10 refs.

33276 **Stabilized fuel with silica support structure.** Poco, J.F.; Hrubesh, L.W. To Dept. of Energy. 1991. USA patent application 7-750,681. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93019327. Source: OSTI; NTIS; GPO Dep.

This report describes a stabilized fuel which is supported by a silica support structure. The silica support structure provides a low density, high porosity vehicle for safely carrying hydrocarbon fuels. The silica support structure for hydrocarbon fuel does not produce toxic material residues on combustion which would pose environmentally sensitive disposal problems. The silica stabilized fuel composition is useful as a low temperature, continuous burning fire starter for wood or charcoal.

33277 (PNL-SA–22730) **In situ observation of radiation induced amorphization of crystals with apatite structure.** Wang, L.M. (New Mexico Univ., Albuquerque, NM (United States). Dept. of Earth and Planetary Sciences); Ewing, R.C.; Cameron, M.; Weber, W.J.; Crowley, K.D. Pacific Northwest Lab., Richland, WA (United States). Jun 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830 ;FG04-84ER45099. (CONF-930405–35: Spring meeting of the Materials Research Society, San Francisco, CA (United States), 12-16 Apr 1993). Order Number DE93018450. Source: OSTI; NTIS; INIS; GPO Dep.

Temperature dependence of amorphization doses for 1.5 MeV Kr ion-irradiated $Ca_{10}(PO_4)_6F_2$ and $Ca_2La_8(SiO_4)_6O_2$ were studied with in situ transmission electron microscopy. At low temperatures, $Ca_{10}(PO_4)_6F_2$ became amorphized at lower dose than $Ca_2La_8(SiO_4)_6O_2$. However, the critical amorphization dose increased much more rapidly for the former above 350 K than the latter. At 475 K, $Ca_{10}(PO_4)_6F_2$ required nearly five times of higher dose to become amorphous than $Ca_{10}La_8(SiO_4)_6O_2$. Based on the dose-temperature curves, activation energies for the crystal structure recovery process were determined to be 0.07 eV for $Ca_{10}(PO_4)_6F_2$ and 0.13 eV for $Ca_2La_8(SiO_4)_6O_2$ respectively. The

lower critical amorphization dose and lower activation energy for recovery of $Ca_{10}(PO_4)_6F_2$ are attributed to the weaker P-O bond and the higher fluorine mobility in the structure.

33278 (PNL-SA–22777) **Subcritical crack growth in continuous-fiber reinforced ceramic composites.** Henager, C.H. Jr.; Jones, R.H. Pacific Northwest Lab., Richland, WA (United States). Jun 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930438–28: 95. annual meeting of the American Ceramic Society, Cincinnati, OH (United States), 18-22 Apr 1993). Order Number DE93018784. Source: OSTI; NTIS; GPO Dep.

Time-dependent crack growth measurements of ceramic composites in varying PO_2 environments were conducted on materials consisting of chemical vapor infiltration (CVI) SiC reinforced with Nicalon fibers having C- and BN-interfaces. Crack velocities are determined as a function of applied stress intensity and time for varying O_2 levels. Results are presented for crack growth in pure Ar and in Ar plus 2000-, 5000-, 10,000-, and 20,000-ppM 02 atmospheres at 1100C. A 2D micromechanics model is used to represent the time-dependence of observed fiber bridging events and is able to rationalize the observed phenomena.

33279 (SAND–92-2487C) **A constitutive theory for rigid polyurethane foam.** Neilsen, M.K. (Sandia National Labs., Albuquerque, NM (United States)); Krieg, R.D.; Schreyer, H.L. Sandia National Labs., Albuquerque, NM (United States). [1992]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-931121–4: Annual winter meeting of the American Society of Mechanical Engineers, New Orleans, LA (United States), 28 Nov - 3 dec 1993). Order Number DE93011596. Source: OSTI; NTIS; GPO Dep.

Rigid, closed-cell, polyurethane foam consists of interconnected polyurethane plates which form cells. When this foam is compressed, it exhibits an initial elastic regime which is followed by a plateau regime in which the load required to compress the foam remains nearly constant. In the plateau regime, cell walls are damaged and large permanent volume changes are generated. As additional load is applied, cell walls are compressed against neighboring cell walls, and the stiffness of the foam increases and approaches a value equal to that of solid polyurethane. When the foam is loaded in tension, the cell walls are damaged and the foam fractures. A constitutive theory for rigid polyurethane foam has been developed. This theory is based on a decomposition of the foam into two parts: a skeleton and a nonlinear elastic continuum in parallel. The skeleton accounts for the foam behavior in the elastic and plateau regimes and is described using a coupled plasticity with continuum damage theory. The nonlinear elastic continuum accounts for the lock-up of the foam due to internal gas pressure and cell wall interactions. This new constitutive theory has been implemented in both static and dynamic finite element codes. Numerical simulations performed using the new constitutive theory are presented.

33280 (SAND–93-0541C) **Photo-induced and electrooptic properties of (Pb,La)(Zr,Ti)O_3 films.** Dimos, D.; Warren, W.L.; Tuttle, B.A. Sandia National Labs., Albuquerque, NM (United States). [1993]. 12p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930405–33: Spring meeting of the Materials Research Society, San Francisco, CA (United States), 12-16 Apr 1993). Order Number DE93017496. Source: OSTI; NTIS; GPO Dep.

Photo-induced changes in the hysteresis behavior of sol-gel derived Pb(Zr,Ti)O_3 (PZT) and (Pb,La)(Zr,Ti)O_3 (PLZT) films have been characterized. Film photosensitivity has been evaluated with respect to magnitude of effects, time response and spectral dependence. Photo-induced hysteresis changes exhibit a stretched-exponential time dependence, which implies a dispersive mechanism. The spectral dependence is strongly peaked at the band edge ($\sim$ 3.4 eV), which indicates that generation of electron-hole pairs in the material is critical. The photo-induced hysteresis changes are reproducible and stable, which indicates that the controlling charge traps are stable. However, improvements in film photosensitivity will be required to develop these materials for optical memory applications.

33281 (SAND–93-0743C) **Role of pressure in the study of fullerenes.** Schirber, J.E. (Sandia National Labs., Albuquerque, NM (United States)); Samara, G.A.; Morosin, B.; Assink, R.; Loy, D.; Wang, H.; Williams, J.; Murphy, D.; Kortan, A.R.; Rossiensky, M.; Zhou, O.; Zhu, Q.; Kniaz, K.; Fischer, J.E. Sandia National Labs., Albuquerque, NM (United States). 1993. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930676–35: 14. international conference of the International Association for the Advancement of High Pressure Science and Technology, Colorado Springs, CO (United States), 27 Jun - 2 jul 1993). Order Number DE93018839. Source: OSTI; NTIS; INIS; GPO Dep.

Although fullerenes and their compounds are very new and exhibit new phenomena, pressure has already been an important factor in the characterization and study of these materials. In order to illustrate this, the authors will review collaborative studies on: (i) the effect of pressure on alkali and alkaline earth doped C_{60} superconductors, (ii) the effect of pressure and pressure medium on the ordering temperature of C_{60}, and (iii) the role of pressure in the study of the feasibility of using C_{60} as "lattice sieves" for separation of gases.

33282 (SAND–93-1661C) **Stress pulse phenomena.** McGlaun, M. Sandia National Labs., Albuquerque, NM (United States). 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9301125–2: Los Alamos Technology Exchange workshop on dynamic response of materials to pulsed heating, Los Alamos, NM (United States), 22-25 Jan 1993). Order Number DE93019064. Source: OSTI; NTIS; GPO Dep.

This paper is an introductory discussion of stress pulse phenomena in simple solids and fluids. Stress pulse phenomena is a very rich and complex field that has been studied by many scientists and engineers. This paper describes the behavior of stress pulses in idealized materials. Inviscid fluids and simple solids are realistic enough to illustrate the basic behavior of stress pulses. Sections 2 through 8 deal with the behavior of pressure pulses. Pressure is best thought of as the average stress at a point. Section 9 deals with shear stresses which are most important in studying solids.

33283 (UCRL-CR–114992-Vol.2) **Optics survivability support: Volume 2, Final report.** Wild, N. (JAYCOR, San Diego, CA (US)); Simpson, T.; Busdeker, A.; Doft, F. Lawrence Livermore National Lab., CA (United States); JAYCOR, San Diego, CA (United States). Jan 1993. 194p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (J–204-93-0052/2789). Order Number DE93040310. Source: OSTI; NTIS; GPO Dep.

This Volume 2 of the Optics Survivability Support Final Report contains plots of all the data contained in the computerized Optical Glasses Database. All of these plots are accessible through the Database, but are included here as a convenient reference. The first three pages summarize the types of glass included with a description of the radiation source, test date and the original data reference. This information is included in the Database as a macro button labeled "LLNL DATABASE." Following this summary is an Abbe chart showing which glasses are included and where they lie as a function of ν_d and n_d. This chart is also callable through the Database as a macro button labeled "ABBEC."

33284 Imbedded catalyst for removal of sulphur compounds and nitrogen oxides from fluid streams. Gunning, H. 9 Jan 1993. Filed date 8 Jul 1991. Canada patent application 2046460. 22p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

An improved form of regeneratable catalyst is disclosed which is capable of providing reactive oxygen for the partial oxidation of sulfur-containing compounds to produce sulfur. Such a catalyst is useful in a method of removing sulfur compounds including both sulfur oxides and hydrogen sulfide from a fluid stream and decomposing such compounds to produce sulfur. The improved catalyst is formed by depositing alkali metal sulfide and sulfide(s) or selenide(s) of metal(s) showing polyvalent and/or amphoteric character, such as zinc, within the matrix or body of a microporous type support, preferably alumina, to produce an imbedded catalyst. The

catalyst activity is sustained by exposure to a source of oxygen, such as air, sulfur dioxide, or nitrogen peroxide. A catalyst so formed may be used to absorb sulfur dioxide from flue gas and convert it to sulfur, while higher oxides of nitrogen and carbon dioxide are being absorbed for subsequent recovery. The invention is particularly applicable to the removal of hydrogen sulfide and other sulfur compounds from sour natural gas and other fluid streams, and for the conversion of the sulfur in those streams to elemental sulfur.

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Refer also to citation(s) 33386, 33454, 34596

33285 (DOE/CE/15522–T7) **AQUA-SHEAR Mixer test project: DOE invention No. 522: Final technical report.** ACT Labs., Inc., Canonsburg, PA (United States). [1993]. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-91CE15522. Order Number DE93040717. Source: OSTI; NTIS; GPO Dep.

The AQUA-SHEAR Mixer is an instantaneous in-line continuous static mixer, with application for addition and mixing of solid powders, slurries, liquids, or gases to a flowing liquid. The liquid feed is divided into two equal streams directed through nozzles in end caps of the mixing chamber; the opposing liquid streams collide in the center of the mixing chamber, creating an intensely turbulent zone. Additives are introduced through a port above this zone, resulting in dispersion and mixing with the liquid feed. Mixing tests were conducted and results reported; proposed future tests and possible commercial applications are discussed. Figs, table.

33286 (DOE/ER–0144/11) **Summaries of FY 1993 research in the chemical sciences.** USDOE Office of Scientific and Technical Information, Oak Ridge, TN (United States). Aug 1993. 149p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93011855. Source: OSTI; NTIS; GPO Dep.

The summaries in photochemical and radiation sciences, chemical physics, atomic physics, chemical energy, separations and analysis, heavy element chemistry, chemical engineering sciences, and advanced battery technology are arranged according to national laboratories and offsite institutions. Small business innovation research projects are also listed. Special facilities supported wholly or partly by the Division of Chemical Sciences are described. Indexes are provided for selected topics of general interest, institutions, and investigators.

33287 (ORNL–6741) **Chemical Technology Division progress report, July 1, 1991–December 31, 1992.** Genung, R.K.; Hightower, J.R.; Bell, J.T. Oak Ridge National Lab., TN (United States). May 1993. 150p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93017953. Source: OSTI; NTIS; INIS; GPO Dep.

This progress report reviews the mission of the Chemical Technology Division (Chem Tech) and presents a summary of organizational structure, programmatic sponsors, and funding levels for the period July 1, 1991, through December 31, 1992. The report also summarizes the missions and activities of organizations within Chem Tech for the reporting period. Specific projects performed within Chem Tech's energy research programs, waste and environmental programs, and radiochemical processing programs are highlighted. Special programmatic activities conducted by the division are identified and described. Other information regarding publications, patents, awards, and conferences organized by Chem Tech staff is also included.

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Refer also to citation(s) 32194, 32195, 32197, 32353, 32525, 32598, 32684, 33111, 33227, 33259, 33333, 33694, 33697, 33699, 33743, 33751, 33767, 34462, 34636

33288 (ANL/MSD/CP–79154) **Performance of the Amorphous Materials Diffractometer "GLAD" at IPNS.** Ellison, A.J.G.; Volin, K.J.; Price, D.L.; Crawford, R.K. Argonne National Lab., IL (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States); Houston Univ., TX (United States). DOE Contract W-31109-ENG-38. (CONF-9305177–8: 12. International collaboration of advanced neutron sources meeting (ICANS), Abingdon (United Kingdom), 24-28 May 1993). Order Number DE93017746. Source: OSTI; NTIS; GPO Dep.

The Glass, Liquids, and Amorphous Materials Diffractometer (GLAD) at IPNS has now been commissioned and the first scientific measurements have been carried out. Details of the performance of this inswment, including background, calibration, resolution, data rate, data quality, and data reduction and analysis will be discussed.

33289 (CONF-930159–53) **Detection of single molecules in microspheres.** Barnes, M.D. (Oak Ridge National Lab., TN (United States)); Whitten, W.B.; Ramsey, J.M.; Ng, K.C.; Arnold, S. Oak Ridge National Lab., TN (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From OE/LASE '93: International Society for Optical Engineering (SPIE) conference; Los Angeles, CA (United States); 16-23 Jan 1993. Order Number DE93017776. Source: OSTI; NTIS; GPO Dep.

We have investigated the use of micron-sized liquid droplets as sample medium to detect single fluorescent molecules in solution. The use of microdroplets (5–15 μm diameter) offers several powerful advantages over single-molecule detection schemes involving measurements on bulk liquids where the probe volume is defined by the laser beam. In addition, cavity-quantum electrodynamical (QED) effects have been observed which influence both spontaneous emission rates and fluorescence yields of dye molecules in these microspheres.

33290 (CONF-930672–1) **Solid-state, resistive hydrogen sensors for safety monitoring.** Hoffheins, B.S. (Oak Ridge National Lab., TN (United States)); Lauf, R.J.; Fleming, P.H.; Nave, S.E. Oak Ridge National Lab., TN (United States); Westinghouse Savannah River Co., Aiken, SC (United States). [1993]. 16p. Sponsored by National Aeronautics and Space Administration, Washington, DC (United States). DOE Contract AC05-84OR21400 ;AC09-89SR18035. From 3. international joint ISA POWID/EPRI controls and instrumentation conference; Phoenix, AZ (United States); 7-9 Jun 1993. Order Number DE93017769. Source: OSTI; NTIS; GPO Dep.

Solid-state, resistive hydrogen sensors have been designed and fabricated at Oak Ridge National Laboratory. Sensor response has been successfully tested with H_2 gas in argon and air under ambient temperature and pressure, while immersed in transformer oil at temperatures between 25°C and 90°C, and under site-specific conditions at Westinghouse Savannah River Co. Current versions of the sensors (25 x 25 x 0.6 mm) are small enough to be incorporated into hand-held leak detectors or distributed sensor systems for safety monitoring throughout a large area. Another foreseeable application is in electrical power transformers where the buildup of hydrogen gas accompanies oil breakdown. The use of these sensors to monitor transformer oil changes could help predict and prevent catastrophic failure.

33291 (DOE/CE/23810–10) **Accelerated screening methods for determining chemical and thermal stability of refrigerant-lubricant mixtures, Part 1: Method assessment: Final report.** Kauffman, R. Dayton Univ., OH (United States). Research Inst. Apr 1993. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91CE23810. Order Number DE93040215. Source: OSTI; NTIS; GPO Dep.

This report presents results of a literature search performed to identify analytical techniques suitable for accelerated screening of chemical and thermal stabilities of different refrigerant/lubricant combinations. Search focused on three areas: Chemical stability data of HFC-134a and other non-chlorine containing refrigerant candidates; chemical stability data of CFC-12, HCFC-22, and other chlorine containing refrigerants; and accelerated thermal analytical techniques. Literature was catalogued and an abstract was written for each journal article or technical report. Several thermal analytical techniques were identified as candidates for development into accelerated screening tests. They are easy to operate, are common to most laboratories, and are expected to produce refrigerant/lubricant stability evaluations which agree with the current stability

test ANSI/ASHRAE (American National Standards Institute/ American Society of Heating, Refrigerating, and Air-Conditioning Engineers) Standard 97-1989, "Sealed Glass Tube Method to Test the Chemical Stability of Material for Use Within Refrigerant Systems." Initial results of one accelerated thermal analytical candidate, DTA, are presented for CFC-12/mineral oil and HCFC-22/ mineral oil combinations. Also described is research which will be performed in Part II to optimize the selected candidate.

33292 (DOE/CH–9205) **Fiber optic Raman spectrograph for in situ environmental monitoring: Final report.** Carrabba, M.M. (EIC Labs., Inc., Norwood, MA (United States)). Argonne National Lab., IL (United States); EIC Labs., Inc., Norwood, MA (United States); USDOE Chicago Operations Office, Argonne, IL (United States). Nov 1992. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93019466. Source: OSTI; NTIS; GPO Dep.

This report discusses the development and testing of a small laboratory prototype, field Raman spectrometer which can be used with a fiber optic sampling probe incorporting substrates tailored for surface enhanced Raman spectroscopy (SERS) for low level detection of chemical species. The report also discusses demonstration of apparatus for both laboratory and field environmental samples typical of DOE environmental restoration sites. Preliminary results establish a new technique which can be used in,the field to identify and profile in situ a wide variety of pollutants at the action levels required for remediation.

33293 (DOE/FTR–93014497) **Travel to Brazil concerning high-temperature surfaces in analytical chemistry: Foreign trip report, June 21–26, 1992.** Styris, D.L. Pacific Northwest Lab., Richland, WA (United States). 11 Jul 1992. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93014497. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The traveler attended a symposium on atomic absorption spectrometry. The symposium consisted of two parts. Part 1 (Rio de Janeiro, June 21–24) was oriented toward the techniques of atomic absorption spectrometry, including flame, furnace and hydride techniques. Part 2 (Buzios, June 26–28) was a more specifically directed workshop on electrothermal atomic absorption spectrometry (ET AAS), and included discussions of the fundamental aspects of ET AAS.

33294 (DOE/MC/29109–3356) **Road Transportable Analytical Laboratory (RTAL) system: Quarterly technical report, September–November 1992.** Engineering Computer Optecnomics, Inc., Annapolis, MD (United States). 15 Jan 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC29109. Order Number DE93041217. Source: OSTI; NTIS; GPO Dep.

Goal is development and demonstration of a mobile, field laboratory system for meeting DOE needs for rapid, accurate analysis of hazardous and radioactive contaminants in soil, ground water, and surface waters. Work during this period was carried out on tasks 1 and 2: information required for NEPA, and performance requirements.

33295 (ENEA-RT-INN–92-36) **Supercritical fluids: Industrial applications.** Pignatelli, T. (ENEA, Casaccia (Italy). Area Energia e Innovazione); Barontini, P. 1992. 32p. (In Italian). (RT/INN–92-36). Order Number DE93522941. Source: OSTI; NTIS (US Sales Only).

It is well known that some gases, under particular conditions of temperature and pressure, can reach the state of 'supercritical fluids', characterized by physical and chemical properties half way through gases and real fluids. Practical applications of technologies utilizing supercritical fluids - mainly supercritical carbon dioxide ($SC\text{-}CO_2$) - range from coal liquefaction and extraction and purification processes of natural products for the cosmetics or pharmaceutical industries to food product treatments in order to enhance nutritional and flavour characteristics. More recently, several countries have started preliminary studies and research on the possibility of carrying out enzymatic reactions aimed at the preparation of pharmaceutical derivatives or food additives. This report, about the 'state of the art' and the main perspectives of industrial applications for supercritical fluids, is intended to give some information and knowledge on such an innovative technology.

33296 (INIS-mf–13548, pp. 77-82) **Niobium getter for uranium dioxide.** Bobkov, B.N. (Nauchno-Proizvodstvennoe ob"edinenie "Lutch", Podol'sk (Russian Federation)); Goryachkina, L.F.; Lavrent'ev, E.A.; Lyubimov, D.Yu.; Panov, A.S. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 9.* 225p. Order Number DE94600002. Source: OSTI; NTIS (US Sales Only); INIS.

A heterogeneous process of oxygen transition from UO_2 into niobium getter was studied. It was shown that oxygen chemisorption by getter is a limiting factor of this process. Kinetics of UO_2 composition changes depending on the temperature and geometry of UO_2 and getter was calculated. 8 refs.; 1 fig. (author).

33297 (INIS-RU–347, pp. 218) **Activation determination of C, N and O in mercury diiodide crystals.** Eremeenko, D.O. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Platonov, S.Yu.; Yuminov, O.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. CARBON 12/activation analysis; CARBON 12/quantitative chemical analysis; NITROGEN 14/ activation analysis; NITROGEN 14/quantitative chemical analysis; OXYGEN 16/activation analysis; OXYGEN 16/quantitative chemical analysis; ALPHA REACTIONS; DEUTERON REACTIONS; MERCURY IODIDES; NEUTRONS; SENSITIVITY

33298 (INIS-RU–347, pp. 401) **Activation analysis of isotope-enriched substance of ytterbium-176.** Gorski, B. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Karamyan, S.A.; Oganesyan, Yu.Ts.; Yussonnua, M.; Bogomolov, S.L. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. HAFNIUM/activation analysis; ISOTOPE ENRICHED MATERIALS/activation analysis; ISOTOPE ENRICHED MATERIALS/ytterbium 176; YTTERBIUM/activation analysis; YTTERBIUM 169/isotope ratio; YTTERBIUM 174/isotope ratio; YTTERBIUM 176/isotope ratio; HAFNIUM; IMPURITIES; SENSITIVITY; YTTERBIUM

33299 (INIS-RU–347, pp. 410) **Use of helium ions backscattering method for determination of gold content in ores.** Dikij, N.P. (AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst.); Zabolotnyj, V.D.; Matyash, P.P.; Medvedeva, E.P.; Storizhko, V.E. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. GOLD/ion scattering analysis; ORES/ion scattering analysis; BACKSCATTERING; ELECTRODEPOSITION; ELECTROLYTES; GOLD; HELIUM IONS; MEV RANGE 01-10; ORES; SAMPLE PREPARATION; SENSITIVITY

33300 (INIS-RU–347, pp. 411) **Capability of nuclear microanalysis for determination of microelements content in**

patients with dermatities from regions with favorable and unfavorable radiation situation. Dikij, N.P. (AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst.); Zabolotnyj, V.D.; Matyash, P.P.; Medvedeva, E.P.; Slabospitskij, R.P.; Kutasevich, Ya.F.; Mavrov, I.I.; Rezenkina, L.D.; Pyatikop, I.M.; Gutnev, A.L. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. BLOOD/microanalysis; ELEMENTS/microanalysis; HAIR/microanalysis; SKIN/microanalysis; BLOOD; MICROANALYSIS; ELEMENTS; HAIR; PATIENTS; SAMPLE PREPARATION; SENSITIVITY; SKIN

33301 (INIS-RU–347, pp. 414) **Resonance scattering of alpha-particles on oxygen and its use in nuclear microanalysis.** Soroka, V.I. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Artsimovich, M.V.; Lobach, I.Yu.; Mogil'nik, I.F. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 4 refs. OXYGEN/microanalysis; SILICON/microanalysis; ALPHA REACTIONS; CRYSTALS; ELASTIC SCATTERING; IMPURITIES; MEV RANGE 01-10; OXYGEN; MICROANALYSIS; OXYGEN 16 TARGET; RESONANCE SCATTERING; SILICON; USES

33302 (INIS-RU–347, pp. 417) **Moessbauer study of the fabrication place of Dutch tile found in the lower castlee of Vilnius.** Amulyavichyus, A.S.; Bal'chyunene, M.; Davidonis, R.; Katalinas, K. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. ARCHAEOLOGICAL SPECIMENS/chemical analysis; IRON COMPOUNDS/moessbauer effect; CERAMICS; VALENCE

33303 (INIS-RU–347, pp. 423) **Determination of concentration profile of titanium using reaction $^{48}Ti(p,\gamma)^{49}V$.** Chirt, V.K.; Kolot, V.Ya. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. TITANIUM/nuclear reaction analysis; COATINGS; DISTRIBUTION FUNCTIONS; GAMMA RADIATION; PROTONS; SENSITIVITY; TITANIUM; TITANIUM 48; VANADIUM 49

33304 (INIS-RU–347, pp. 433) **Neutron activation analysis of the moss and forest litter for environment radiation monitoring.** Riekstinya, D.V. (AN Latvijskoj SSR, Riga (Latvia). Inst. Fiziki); Veveris, O.Eh.; Kuznetsova, N.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. AERIAL MONITORING/neutron activation analysis; FOREST LITTER/neutron activation analysis; BIOSATELLITES; ECOSYSTEMS; ENVIRONMENT; RADIOISOTOPES

33305 (ORNL–6749) **Analytical Chemistry Division annual progress report for period ending December 31, 1992.** Shults, W.D. Oak Ridge National Lab., TN (United States). Apr 1993. 255p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93017938. Source: OSTI; NTIS; GPO Dep.

This report is divided into: Analytical spectroscopy (optical spectroscopy, organic mass spectrometry, inorganic mass spectrometry, secondary ion mass spectrometry), inorganic and radiochemistry (transuranium and activation analysis, low-level radiochemical analysis, inorganic analysis, radioactive materials analysis, special projects), organic chemistry (organic spectroscopy, separations and synthesis, special projects, organic analysis, ORNL/UT research program), operations (quality assurance/quality control, environmental protection, safety, analytical improvement, training, radiation control), education programs, supplementary activities, and presentation of research results. Tables are included for articles reviewed or refereed for periodicals, analytical service work, division manpower and financial summary, and organization chart; a glossary is also included.

33306 (ORNL/FTR–4657) **Travel to Italy to attend the Fifteenth International Symposium on Capillary Chromatography: Foreign trip report, May 22, 1993–May 30, 1993.** Ramsey, R.S.; Ramsey, J.M. Oak Ridge National Lab., TN (United States). 7 Jun 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93016771. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Approximately 30 oral presentations and 375 poster presentations by scientists from over 38 different countries were given at this international meeting on capillary chromatography. All aspects of capillary separations were covered including conventional capillary gas chromatography (GC), microbore liquid chromatography (LC), super critical fluid chromatography (SFC), capillary electrophoresis (CE), and novel electrodriven separations recently obtained in micro-channels. Specific topics addressed included environmental, biomedical and pharmaceutical, natural products, and industrial applications.

33307 (ORNL/FTR–4691) **Travel to York, UK to participate in the 28th Colloquium Spectroscopicum Internationale: Foreign trip report, June 26–July 5, 1993.** Ramsey, J.M. Oak Ridge National Lab., TN (United States). 26 Jul 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93018863. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A brief account is given of the international applied spectroscopy conference.

33308 Alkaline solution absorption of carbon dioxide method and apparatus. Hobbs, D.T. To Dept. of Energy. 1991. USA patent application 7-754,840. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93019321. Source: OSTI; NTIS; GPO Dep.

Disclosed is a method for measuring the concentration of hydroxides (or pH) in alkaline solutions, using the tendency of hydroxides to adsorb CO_2. The method comprises passing CO_2 over the surface of an alkaline solution in a remote tank before and after measurements of the CO_2 concentration. Comparison of the measurements yields the adsorption fraction from which the hydroxide concentration can be calculated using a correlation of hydroxide or pH to adsorption fraction. A schematic is given of a process system according to a preferred embodiment of the invention. 2 figs.

33309 (PNL-MA–599-Vol.2) **Analytical Chemistry Laboratory (ACL) procedure compendium: Volume 2, Sample preparation methods.** Pacific Northwest Lab., Richland, WA (United States). [1993]. 155p. Sponsored by USDOE, Washington, DC (United

States). DOE Contract AC06-76RL01830. Order Number DE93019190. Source: OSTI; NTIS; INIS; GPO Dep.

This volume contains the interim change notice for sample preparation methods. Covered are: acid digestion for metals analysis, fusion of Hanford tank waste solids, water leach of sludges/soils/other solids, extraction procedure toxicity (simulate leach in landfill), sample preparation for gamma spectroscopy, acid digestion for radiochemical analysis, leach preparation of solids for free cyanide analysis, aqueous leach of solids for anion analysis, microwave digestion of glasses and slurries for ICP/MS, toxicity characteristic leaching extraction for inorganics, leach/dissolution of activated metal for radiochemical analysis, extraction of single-shell tank (SST) samples for semi-VOC analysis, preparation and cleanup of hydrocarbon- containing samples for VOC and semi-VOC analysis, receiving of waste tank samples in onsite transfer cask, receipt and inspection of SST samples, receipt and extrusion of core samples at 325A shielded facility, cleaning and shipping of waste tank samplers, homogenization of solutions/slurries/sludges, and test sample preparation for bioassay quality control program.

33310 (PNL-MA–599-Vol.3) **Analytical Chemistry Laboratory (ACL) procedure compendium: Volume 3, Inorganic instrumental methods.** Pacific Northwest Lab., Richland, WA (United States). [1993]. 579p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019191. Source: OSTI; NTIS; INIS; GPO Dep.

The methods cover: C in solutions, F (electrode), elements by atomic emission spectrometry, inorganic anions by ion chromatography, Hg in water/solids/sludges, As, Se, Bi, Pb, data calculations for SST (single shell tank?) samples, Sb, Tl, Ag, Pu, O/M ratio, ignition weight loss, pH value, ammonia (N), Cr(VI), alkalinity, U, C sepn. from soil/sediment/sludge, Pu purif., total N, water, C and S, surface Cl/F, leachable Cl/F, outgassing of Ge detector dewars, gas mixing, gas isotopic analysis, XRF of metals/alloys/compounds, H in Zircaloy, H/O in metals, inpurity extraction, reduced/total Fe in glass, free acid in U/Pu solns, density of solns, Kr/Xe isotopes in FFTF cover gas, H by combustion, MS of Li and Cs isotopes, MS of lanthanide isotopes, GC operation, total Na on filters, XRF spectroscopy QC, multichannel analyzer operation, total cyanide in water/solid/sludge, free cyanide in water/leachate, hydrazine conc., ICP-MS, ^{99}Tc, U conc./isotopes, microprobe analysis of solids, gas analysis, total cyanide, H/N_2O in air, and pH in soil.

33311 (PNL-MA–599-Vol.4) **Analytical Chemistry Laboratory (ACL) procedure compendium: Volume 4, Organic methods.** Pacific Northwest Lab., Richland, WA (United States). [1993]. 393p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019192. Source: OSTI; NTIS; INIS; GPO Dep.

This interim notice covers the following: extractable organic halides in solids, total organic halides, analysis by gas chromatography/Fourier transform-infrared spectroscopy, hexadecane extracts for volatile organic compounds, GC/MS analysis of VOCs, GC/MS analysis of methanol extracts of cryogenic vapor samples, screening of semivolatile organic extracts, GPC cleanup for semivolatiles, sample preparation for GC/MS for semi-VOCs, analysis for pesticides/PCBs by GC with electron capture detection, sample preparation for pesticides/PCBs in water and soil sediment, report preparation, Florisil column cleanup for pesticide/PCBs, silica gel and acid-base partition cleanup of samples for semi-VOCs, concentrate acid wash cleanup, carbon determination in solids using Coulometrics' CO_2 coulometer, determination of total carbon/total organic carbon/total inorganic carbon in radioactive liquids/soils/sludges by hot persulfate method, analysis of solids for carbonates using Coulometrics' Model 5011 coulometer, and soxhlet extraction.

33312 (PNL-MA–599-Vol.5) **Analytical Chemistry Laboratory (ACL) procedure compendium: Volume 5, Radiochemistry analyses.** Pacific Northwest Lab., Richland, WA (United States). [1993]. 641p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019193. Source: OSTI; NTIS; INIS; GPO Dep.

This large volume contains interim change notices. All radiochemical analysis methods are covered.

33313 (PNL-MA–599-Vol.6) **Analytical Chemistry Laboratory (ACL) procedure compendium: Volume 6, Physical testing.** Pacific Northwest Lab., Richland, WA (United States). [1993]. 72p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019194. Source: OSTI; NTIS; INIS; GPO Dep.

This volume contains the interim change notice for physical testing. Covered are: properties of solutions, slurries, and sludges; rheological measurement with cone/plate viscometer; % solids determination; particle size distribution by laser scanning; penetration resistance of radioactive waste; operation of differential scanning calorimeter, thermogravimetric analyzer, and high temperature DTA and DSC; sodium rod for sodium bonded fuel; filling SP-100 fuel capsules; sodium filling of BEATRIX-II type capsules; removal of alkali metals with ammonia; specific gravity of highly radioactive solutions; bulk density of radioactive granular solids; purification of Li by hot gettering/filtration; and Li filling of MOTA capsules.

33314 (PNL-MA–599-Vol.7) **Analytical Chemistry Laboratory (ACL) procedure compendium: Volume 7, Safety operation procedure for hot cell.** Pacific Northwest Lab., Richland, WA (United States). [1993]. 72p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019195. Source: OSTI; NTIS; INIS; GPO Dep.

This volume contains the interim change notice for the safety operation procedure for hot cell. It covers the master-slave manipulators, dry waste removal, cell transfers, hoists, cask handling, liquid waste system, and physical characterization of fluids.

33315 (SAND–92-0229) **The minimum detection limits of RDX and TNT deposited on various surfaces as determined by ion mobility spectroscopy.** Rodacy, P. Sandia National Labs., Albuquerque, NM (United States). Aug 1993. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018521. Source: OSTI; NTIS; GPO Dep.

An Ion Mobility Spectrometer (IMS) was used to determine the detection limits of RDX and TNT on six different substrates. The preparation of the explosive deposits on the surfaces is examined as well as effects due to the size, uniformity, method of application, and time that a deposit has been on a surface. Sampling methods are discussed along with effects of the surface topology. The transfer of explosives from a hand to a surface, and methods to reduce the detection limits are presented.

33316 (UCRL-JC–112182) **Penetrometer compatible, fiber-optic sensor for continuous monitoring of chlorinated hydrocarbons – field test results.** Milanovich, F.P.; Brown, S.B.; Colston, B.W. Jr. Lawrence Livermore National Lab., CA (United States). Apr 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9305124–3: Chemical sensor symposium, Honolulu, HI (United States), 16-21 May 1993). Order Number DE93017974. Source: OSTI; NTIS; INIS; GPO Dep.

We have developed and field tested a fiber optic chemical sensor for use in environmental monitoring and remediation. The principle of detection is colorimetric and is based on an irreversible chemical reaction between a specific reagent and the target compound. The formation of reaction products are monitored remotely with optical fibers. Successive or on-demand measurements are made possible with a reagent reservoir and a miniature pumping system. The sensor has been evaluated against gas chromatography standards and has demonstrated accuracy and sensitivity (>5ppb w/w) sufficient for the environmental monitoring of the contaminants tricoroethlyene (TCE) and chloroform. The sensor system can be used for bench-top analyses or for in-situ measurements such as groundwater and vadose monitoring wells or in Penetrometry mediated placements.

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Refer also to citation(s) 32161, 32162, 32460, 32507, 32508, 32519, 32675, 32684, 32715, 33083, 33104, 33217, 33247, 33291, 33723, 33774, 34601, 34653, 34654

33317 (ANL/CHM/CP–79281) **NMR imaging of anomalous solvent transport in macromolecular materials.** Cody, G.D.; Botto, R.E. Argonne National Lab., IL (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930802–8: 206. American Chemical Society national meeting, Chicago, IL (United States), 22-27 Aug 1993). Order Number DE93019518. Source: OSTI; NTIS; GPO Dep.

Systems in which a change in state accompanies solvent transport, exhibits a sharp solvent front that penetrates the sample like a shock wave; such behavior is called case II transport to distinguish it from Fickian transport. This occurs in macromolecule/solvent systems such as bituminous coals swollen in pyridine; the only requirement for case II behavior is a glassy state in the dry state, crossing over to a rubbery state during solvent uptake. A sharply defined solvent front and a constant front velocity are present. Case II behavior are related to relative magnitudes of characteristic diffusion times and molecular relaxation times. An experimental study of case II transport of methanol in polyethylmethacrylate and pyridine in coal using optical and NMR imaging techniques is reported in this paper.

33318 (ANL/CHM/CP–79706) **Encounters of H and D atoms with O_2 in water: Relative diffusion and reaction rates.** Han, P.; Bartels, D.M. Argonne National Lab., IL (United States). [1993]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9305254–1: Ultrafast reaction dynamics and solvent effects, Asnieres Sur Oise (France), 11-15 May 1993). Order Number DE93018587. Source: OSTI; NTIS; GPO Dep.

Diffusive encounters of H and D atoms with O_2 in water are investigated with the time-domain EPR free induction decay attenuation technique. Given the paramagnetic triplet ground state of the O_2 molecule, it is expected that all H-O_2 encounters will contribute to spin dephasing, regardless of whether reaction to form HO_2 occurs. In H_2O the second-order spin-spin dephasing rate of H in the presence of O_2 is 1.94×10^{10} M^{-1} sec^{-1} at 25°C, with an activation energy of 11.22 ± 0.33 kJ/mole between 8 and 60°C. In a mixture of 90% D_2O and 10% H_2O, H atom dephasing is marginally slower in the same temperature range. Dephasing of D atoms in 90% D_2O is ca. 5–10% slower than H, indicating that diffusion of D is slower than H. The results are analyzed in terms of other available data concerning H and O_2 diffusion and the reaction rate in water. It seems clear that neither the Stokes Einstein hydrodynamic theory nor classical activated rate theory applies to the diffusion of light hydrophobic gases in water. The authors tentatively conclude that H-O_2 spin exchange is slightly less efficient than can be predicted in the theoretical diffusion limit.

33319 (CONF-931121–9) **Densities and viscosities of ternary ammonia/water fluids.** Reiner, R.H.; Zaltash, A. Oak Ridge National Lab., TN (United States). Mar 1993. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Annual winter meeting of the American Society of Mechanical Engineers; New Orleans, LA (United States); 28 Nov - 3 dec 1993. Order Number DE93015966. Source: OSTI; NTIS; GPO Dep.

The densities, viscosities, and boiling points (at barometric pressure) of solutions formed by inorganic salts dissolved in an ammonia/water (NH_3/H_2O) solvent have been measured. These ternary solutions of ammonia/water/dissolved salt are being investigated to reduce rectification requirements and to expand the temperature range of ammonia/water in advanced absorption cycles. Densities and viscosities of these fluids were measured over the temperature range of 283.15 to 343.15 K (10.0 to 70.0°C). Observed densities and viscosities were expressed as empirical functions of temperature by means of the least-squares method. The dynamic viscosities of ternary fluids were found to be three to seven times greater than those of the binary system of NH_3/H_2O, which implies that a substantial decrease in the film heat and mass transfer coefficient is possible. However, because this quantitative linkage is not well understood, direct measurements of heat and mass transfer rates in a minisorber are recommended and planned.

33320 (DOE/ER/13263–T1) **Oligomer and mixed-metal compounds, potential multielectron transfer catalysts: Progress report, January 1, 1990–January 1, 1993.** Rillema, D.P. North Carolina Univ., Charlotte, NC (United States). Dept. of Chemistry. [1993]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-84ER13263. Order Number DE93019592. Source: OSTI; NTIS; GPO Dep.

Physical, photophysical, and photochemical properties of Ru(II), Re(I), Pt(II), and Cu(II) monometallic complexes and of Ru(II)-Ru(II), Ru(II)-Co(III), Ru(II)-Re(I) bimetallic complexes were investigated. In an application, Pt and Au working electrodes were modified with the hydrogel kappa-carrageenan (anionic polysaccharide from seaweed), which was cured on the electrode surface with Ru(II) trisbipyridine and methyl viologen. Max photocurrent obtained was 12 $\mu A.cm^2$.

33321 (DOE/ER/13617–T1) **Selective transformation of carbonyl ligands to organic molecules: Progress report, November 15, 1992–November 14, 1993.** Cutler, A.R. Rensselaer Polytechnic Inst., Troy, NY (United States). 10 Aug 1993. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER13617. Order Number DE93019988. Source: OSTI; NTIS; GPO Dep.

This report is divided into: manganese acyls as hydrosilation substrates/precatalysts; manganese carbonyl-catalyzed hydrosilation of organic compounds; and indenyl ruthenium carbonylation chemistry.

33322 (DOE/ER/13619–7) **Resonance Raman and photophysical studies of transition metal complexes in solution and entrapped in zeolites: Progress report, August 1, 1990–January 1993.** Kincaid, J.R. Marquette Univ., Milwaukee, WI (United States). Dept. of Chemistry. [1993]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER13619. Order Number DE93019892. Source: OSTI; NTIS; GPO Dep.

Area of most intense activity involves study of effects of entrapment of ruthenium(II)-polypyridyl complexes within the supercages of Y-zeolite. Results of initial studies document alterations in photophysical properties of entrapped complexes and provide insight into the factors responsible for these changes. A second major activity was to undertake an investigation of the feasibility of entrapment of metallophthalocyanines within the Y-zeolite supercages. Initial problems in preparative methodology used for these systems have been overcome and several systems have now been prepared and purified for projected photoredox studies. A third major objective was to develop and utilize a sound interpretive framework for resonance Raman (RR) and time-resolved RR (TR^3) methods for investigating subtle perturbations in ground- and ^{3}MLCT-state electronic structure which might be induced by substituent or environmentally-induced asymmetry, effects which could possibly lead to critical functional alterations.

33323 (DOE/ER/13859–32) **Numerical estimation of adsorption energy distributions from adsorption isotherm data with the expectation-maximization method.** Stanley, B.J. (Tennessee Univ., Knoxville, TN (United States). Dept. of Chemistry); Guiochon, G. Tennessee Univ., Knoxville, TN (United States). Dept. of Chemistry; Oak Ridge National Lab., TN (United States). [1993]. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-88ER13859. Order Number DE93019460. Source: OSTI; NTIS; GPO Dep.

The expectation-maximization (EM) method of parameter estimation is used to calculate adsorption energy distributions of molecular probes from their adsorption isotherms. EM does not require prior knowledge of the distribution function or the isotherm, requires no smoothing of the isotherm data, and converges with high stability towards the maximum-likelihood estimate. The method is therefore robust and accurate at high iteration numbers. The EM algorithm is tested with simulated energy distributions corresponding to unimodal Gaussian, bimodal Gaussian, Poisson distributions, and the distributions resulting from Misra isotherms. Theoretical isotherms are generated from these distributions using the Langmuir model, and then chromatographic band profiles are computed using the ideal model of chromatography. Noise is then

introduced in the theoretical band profiles comparable to those observed experimentally. The isotherm is then calculated using the elution-by-characteristic points method. The energy distribution given by the EM method is compared to the original one. Results are contrasted to those obtained with the House and Jaycock algorithm HILDA, and shown to be superior in terms of robustness, accuracy, and information theory. The effect of undersampling of the high-pressure/low-energy region of the adsorption is reported and discussed for the EM algorithm, as well as the effect of signal-to-noise ratio on the degree of heterogeneity that may be estimated experimentally.

33324 (DOE/ER/14295–1) **Transition metal catalysis in the generation of petroleum and natural gas: Progress report, [1992–1993].** Mango, F. Rice Univ., Houston, TX (United States). [1993]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-92ER14295. Order Number DE93019698. Source: OSTI; NTIS; GPO Dep.

A new hypothesis is introduced for the generation of petroleum and natural gas. The transition metals, activated under the reducing conditions of diagenesis, are proposed as catalysts in the generation of light hydrocarbons. The objective of this proposal is to test that hypothesis. Transition metals (Ni, V, Ti, Co, Fe), in kerogen, porphyrins, and as pure compounds, will be tested under catagenic conditions for catalytic activity in the conversion of normal paraffins and hydrogen into light hydrocarbons. If the hypothesis is correct, kerogenous transition metals should become catalytically active under the reducing conditions of diagenesis and catalyze the conversion of paraffins into the light hydrocarbons seen in petroleum. Moreover, the C_1-C_4 hydrocarbons generated catalytically should be similar in molecular and isotopic compositions to natural gas.

33325 (DOE/MC/29228–3408) **Selective methane oxidation over promoted oxide catalysts: Quarterly technical progress report, March 1, 1993–May 31, 1993.** Klier, K.; Herman, R.G.; Sarkany, J.; Sun, Q. Lehigh Univ., Bethlehem, PA (United States). Zettlemoyer Center for Surface Studies. Jun 1993. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG21-92MC29228. Order Number DE93040001. Source: OSTI; NTIS; GPO Dep.

A 1 wt% SO_4^{2-}/1 wt% Sr/La_2O_3 catalyst has been shown by us to be one of the most active catalyst for the oxidative coupling of CH_4 to C_2 hydrocarbons. One of the by-products is CO_2 and this is a potential strong poison for the formation of C_2^+ products. Hence, various pretreatments of this catalyst were studied in terms of effect on the catalytic performance. Before the reaction was carried out at 500 or 550°C, the catalyst was pretreated in flowing air or He at 500, 700, or 800°C. Relative to the 500°C treatment, the pretreatment in air at 700°C only slightly decreased the C_2^+ selectivity while the CO_x selectivity increased. This effect was larger when the pretreatment was carried out at 800°C. It was observed that the deactivation effect was slightly smaller when the pretreatments were carried out in He instead of air. For both air and He, the CH_4, conversion and the C_2 %yield showed more or less parallel changes (small decreases) with increasing pretreatment temperature. After a standard pretreatment (air, 500°C, 1 hr), the reaction temperature was increased stepwise from 500 to 700°C and then lowered to 550 (or 500)°C. It was observed that the catalytic performance showed deactivation towards the C_2^+ products. Decreasing stepwise the total flow rate (GHSV) of the reacting gas mixture (CH_4/air = 1/1) from 70,175 to 5,388 ℓ/kg catal/hr at a reaction temperature of 550°C caused large changes in both the activity and selectivity. After going back at 550°C to the original GHSV = 70,175 ℓ/kg catal/hr, the temperature was increased stepwise up to 600°C. Up to 580°C, the catalytic activity and selectivity did not change very much.

33326 (DOE/PC/89785–14) **The single electron chemistry of coals: [Quarterly] report, January 1–March 31, 1993.** Larsen, J.W.; Rothenberg, S.E. Lehigh Univ., Bethlehem, PA (United States). Dept. of Chemistry. [1993]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-89PC89785. Order Number DE93019778. Source: OSTI; NTIS; GPO Dep.

Following the position of the nitrile band and using the assumption that there is a linear relationship for between the extent of charge transfer and frequency, a 69% charge transfer was obtained and successfully replicates Flowers' results. If a Diels-Alder reaction occurred, we would expect the position of nitrile group to have shifted down field to the 2260-2240 cm^{-1} range for a saturated alkyl nitrile. There is no evidence for this type of reaction under these conditions since we obtained a shift upfield from 2229 cm^{-1} to 2200 cm^{-1}. There are some peaks of interest in the 1660-1300 cm^{-1} range of the deposited coals which will be investigated. The TCNE-Illinois No. 6 reaction mixture will be heated from room temperature to 180°C within the Harrick cell during IR analysis to see if a Diels-Alder or other additions reaction could occur.

33327 (DOE/PC/91298–7) **New catalysts for coal processing: Metal carbides and nitrides: Seventh quarterly technical report, [March–May 1993].** Oyama, S.T. Clarkson Univ., Potsdam, NY (United States). Dept. of Chemical Engineering. [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91298. Order Number DE93019748. Source: OSTI; NTIS; GPO Dep.

In this reporting period we have worked in the following two areas: (1) Analysis of the temperature-programmed method of preparation of materials. (2) Testing of catalysts in the high-pressure trickle-bed reactor. We have prepared carbides and nitrides of molybdenum, tungsten, vanadium, and niobium (MO_2C, WC, VN, and NbC) by a temperature-programmed method of synthesis. In order to better understand the preparation method we have carried out in-depth studies of the formation of vanadium nitride and niobium carbide. In both materials it appears that the transformation is limited by diffusion of oxygen in the bulk oxide precursors, V_2O_5 and Nb_2O_5. We have modelled the transformation using a standard diffusion equation, $\partial c/\partial t = D\partial^2 c/\partial x^2$, except that we have used a temperature-dependent diffusion coefficient, $D = D^\circ \exp(-E/RT)$, and imposed a linear heating rate, $T = T^\circ + \beta t$. We have generated computer solutions to this equation which allows us to calculate solid-state oxygen diffusivities directly from temperature-programmed experiments. This is a substantial achievement since such diffusivities are difficult to obtain by conventional methods. In this reporting period we have also continued testing catalysts in the high-pressure trickle-bed reactor. We have experimented with a number of operating conditions, especially temperature. We found that at 300°C conversions were somewhat low, and that at 400°C excessive cracking occurred, and have settled for the following conditions: 370°C at 450 psig with a liquid feed rate of 5 cm^3/h and a hydrogen feed of 150 cm^3/min.

33328 (DOE/PC/91301–7) **Ethanol synthesis and water gas shift over bifunctional sulfide catalysts: Technical progress report, March 1993–May 1993.** Klier, K.; Herman, R.G.; Richards-Babb, M. Lehigh Univ., Bethlehem, PA (United States). Jun 1993. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG22-91PC91301. Order Number DE93040616. Source: OSTI; NTIS; GPO Dep.

Study of preparation of MoS_3, decomposition to form MoS_2, and the Cs-containing reagents and techniques to achieve surface doping of the MoS_2 with Cs was begun. Goal is to achieve a high surface area catalyst containing lower quantities of the Cs promoter in a highly dispersed state. Using high resolution electron spectroscopy for chemical analysis and solid state Extended Hueckel (EH) theory investigation and interpretation of electronic structure of MoS_2 (hexagonal 2H form, 2 MoS_2 molecules/unit cell) was carried out. The theoretical valence band of MoS_2 was obtained by modification of density of states. Qualitative agreement theoretical and experimental MoS_2 valence bands was obtained after parameterization of EH input ionization potentials H_{ii} and Slater-type orbital (STO) double zeta coefficients c_i. Theoretical energy dispersion curves 2-D and 3-D MoS_2 also compared well with experimental energy dispersion curves. Highest occupied band of valence band is shown to consist of contributions not only from Mo $4d_{z2}$ orbitals but also from Mo $4d_{xy}$ and Mo $4d_{x2-y2}$ orbitals. The theoretical systems 2-D MoS_2 and 3-D MoS_2, containing zero for the former and an infinite number of Van der Waals gaps for the latter, exhibit direct and indirect gaps, respectively. Nature of 2H-MoS_2 indirect gap is found to be directly linked to the interaction of crystal orbitals across Van der Waals gap between adjacent layers of MoS_2 in the realistic 3-D model. Thus, the electronic properties and ability of adsorbing and activating hydrogen of very small and

thin particles of MoS_2 might be expected to be different from large bulk particles of MoS_2.

33329 (DOE/PC/92109–T1) **Direct aromatization of methane: Quarterly technical progress report No. 2, January 1–March 31, 1993.** Altamira Instruments, Inc., Pittsburgh, PA (United States). 30 Jun 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92PC92109. Order Number DE93040631. Source: OSTI; NTIS; GPO Dep.

The design of the quench reactor has been completed. A high temperature furnace, capable of reaching 1540°C has been ordered. Thermodynamic equilibrium calculations were carried out in order to determine the maximum possible yields of various products from methane pyrolysis, assuming that the reaction could be quenched at C_{10} aromatics. Acetylene, benzene and naphthalene were identified as the major products of such a process. Ethylene, propylene, cyclopentadiene, methylnaphthalene and toluene, vinylacetylene, butadiene, and propadiene were identified as minor products. The yields of benzene and naphthalene are highest in the temperature range between 1350–1550 K, with a maximum aromatic yield of ca. 45% (benzene + naphthalene) expected at about 1475 K (ca. 1200°C).

33330 (DOE/PC/92112–T2) **Novel catalysts for methane activation: Quarterly report No. 2, January 1, 1993–March 31, 1993.** Hirschon, A.S.; Malhotra, R.; Wilson, R.B. SRI International, Menlo Park, CA (United States). 7 Jul 1993. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-92PC92112. Order Number DE93040630. Source: OSTI; NTIS; GPO Dep.

The objectives of this project are to test novel fullerene based catalysts for application in methane activation. Fullerenes are a recently discovered allotrope of carbon that have been found to possess unusual properties, some of which may be ideal for methane conversion to higher hydrocarbons. The project is divided into three technical tasks. Task 1 deals with the synthesis and characterization of the fullerenes and fullerene soots, Task 2 with the testing of the catalysts, and Task 3 with the evaluation of the results and technical reporting requirements. This quarter we prepared fullerene soot and conducted experiments to determined its reactivity towards methane, hydrogen, and ethylene. The results are summarized: (1) Soot containing approximately 12-14 wt % fullerenes was prepared by the discharge method of Haufler et al. SRI is in the process of developing methodology to produce large scale amounts of fullerenes and fullerene based materials and is working with a private company to that end. In order to provide a background of fullerene soot and describe some of these methods we have included Appendix A. (2) We conducted some preliminary experiments in order to determine the temperature regime at which fullerene based soot would begin to be active for methane activation. We also were interested to determine if the soot would interact with methane or any of the product gases to undergo hydrogenation or methanation reactions.

33331 (INIS-mf–13548, pp. 56-62) **Interaction of oxide nuclear fuel with metallic Th, U and Zr.** Lyalyushkin, N.V. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (Russian Federation)); Kapshukov, I.I.; Sudakov, L.V.; Skiba, O.V. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 9.* 225p. Order Number DE94600002. Source: OSTI; NTIS (US Sales Only); INIS.

Interaction of UO_2-PuO_2,$(U_{0.82}Pu_{0.18})O_2$,$(U_{0.95}Gd_{0.05})O_2$, $(U_{0.90}Gd_{0.10})O_2$ and $(U_{0.80}Gd_{0.20})O_2$ with powdery metals Th, U and Zr during heat treatment up to 1200°C under conditions of closed volume has been investigated by the X-ray method. It has been established that the main result of metal effect is reduction of oxides which is first of all seen in increasing the crystalline lattice parameter. Uranium dioxide is reduced under given condition to the $UO_{1.98}$ composition, plutonium dioxide - to the Pu_2O_3 A-form. The final reduction product $(U_{0.82}Pu_{0.18})O_2$ is an oxide with the O/M≈<1.91 relation, and $(U_{1-y}Gd_y)O_2$-with O/M≈<Y/2. 5 refs.; 5 figs.; 1 tab. (author).

33332 (LA-UR–93-2372) **Temperature lowering in cryogenic chemical-synthesis techniques and system.** Martinez, H.E.; Nelson, T.O.; Vikdal, L.N. Los Alamos National Lab., NM (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930703–17: International cryogenic engineering conference and international cryogenic materials conference, Albuquerque, NM (United States), 12-16 Jul 1993). Order Number DE93018348. Source: OSTI; NTIS; INIS; GPO Dep.

When evaluating a chemical synthesis process for a reaction that occurs on the cryogenically cooled walls, it is sometimes necessary to reduce the wall temperatures to enhance the chemical process. To evaluate the chemical process at lower than atmospheric boiling of liquid nitrogen, we built a system and used it to reduce the temperature of the liquid nitrogen. The technique of lowering the liquid nitrogen temperature by reducing the pressure of the boil-off is established knowledge. This paper presents the engineering aspects of the system, design features, equipment requirements, methods of control, and results of the chemical synthesis. The heat input to the system was ≈400 watts, placing a relatively large demand on the pumping system. Our system is a scale-up of the small laboratory experiment, and it provides the information needed to design an effective system. The major problem encountered was the large quantity of liquid escaping the system during the processing, placing a large gas load on the vacuum system.

33333 (ORNL/TM–12286) **Detection of nitroesters and moisture in combustible cartridge case wall by indicator strips and instruments: Final report.** Ho, C.H.; Moneyhun, J.H.; Agouridis, D.C.; Gayle, T.M.; Hurst, G.B.; Griest, W.H. Oak Ridge National Lab., TN (United States). 30 Sep 1992. 65p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93013458. Source: OSTI; NTIS; GPO Dep.

Nitroester migration into the case wall from the propellant and moisture accumulation within the case have been identified as important internal and external (respectively) factors which contribute to the physical deterioration of combustible cartridge case (ccc) munitions. The latter factor also may hinder proper ignition of the ccc and cause incomplete combustion in firing. Visual indicators sensitive to these factors and affixed to ccc rounds would allow quality assurance specialists or gun crews in the field to rapidly determine the potential reliability of individual rounds. Previous work in this task identified chemistries suitable for the detection of nitroesters and moisture in the ccc wall. A version of the Griess reaction was modified for a dry colorimetric indicator which in the presence of nitroglycerin (NG) or diethyleneglycol dinitrate (DEGDN) generates a brilliant red color. Inorganic salts such as cupric chloride, which changes from brown to blue-green upon hydration, were suggested as promising visual indicators of moisture. This report describes the development and preliminary testing of prototype nitroester and moisture indicator strips, and the scoping of two instrumental techniques, infrared spectroscopy and electrical capacitance, which could lead to portable instruments for rapid and nondestructive testing of ccc in the field.

33334 (ORNL/TM–12322) **Thermophysical properties of saturated light and heavy water for Advanced Neutron Source applications.** Crabtree, A.; Siman-Tov, M. Oak Ridge National Lab., TN (United States). May 1993. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93017384. Source: OSTI; NTIS; INIS; GPO Dep.

The Advanced Neutron Source is an experimental facility being developed by Oak Ridge National Laboratory. As a new nuclear fission research reactor of unprecedented flux, the Advanced Neutron Source Reactor will provide the most intense steady-state beams of neutrons in the world. The high heat fluxes generated in the reactor [303 MW(t) with an average power density of 4.5 MW/L] will be accommodated by a flow of heavy water through the core at high velocities. In support of this experimental and analytical effort, a reliable, highly accurate, and uniform source of thermodynamic and transport property correlations for saturated light and heavy water were developed. In order to attain high accuracy in the correlations, the range of these correlations was limited to the proposed Advanced Neutron Source Reactor's nominal operating

conditions. The temperature and corresponding saturation pressure ranges used for light water were 20–300°C and 0.0025–8.5 MPa, respectively, while those for heavy water were 50–250°C and 0.012–3.9 MPa. Deviations between the correlation predictions and data from the various sources did not exceed 1.0%. Light water vapor density was the only exception, with an error of 1.76%. The physical property package consists of analytical correlations, SAS codes, and FORTRAN subroutines incorporating these correlations, as well as an interactive, easy-to-use program entitled QuikProp.

33335 **Crystalline titanate catalyst supports.** Anthony, R.G.; Dosch, R.G. To Dept. of Energy. 1991. USA patent application 7-751,003. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93019325. Source: OSTI; NTIS; GPO Dep.

A series of new crystalline titanates (CT) are shown to have considerable potential as catalyst supports. For Pd supported catalyst, the catalytic activity for pyrene hydrogenation was substantially different depending on the type of CT, and one was substantially more active than Pd on hydrous titanium oxide (HTO). For 1-hexene hydrogenation the activities of the new CTs were approximately the same as for the hydrous metal oxide supports.

33336 (SAND–93-1554C) **Mineral hydrolysis kinetics.** Westrich, H.R. (Sandia National Labs., Albuquerque, NM (United States)); Cygan, R.T.; Arnold, G.W.; Casey, W.H. Sandia National Labs., Albuquerque, NM (United States); California Univ., Davis, CA (United States). Dept. of Land, Air, and Water Resources. [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9307110–1: Basic energy sciences geosciences conference on rock-water interaction, Berkeley, CA (United States), 15-16 Jul 1993). Order Number DE93017501. Source: OSTI; NTIS; GPO Dep.

Dissolution rate laws for silicate mineral weathering can be related to kinetics of ligand-exchange reactions. This relation is being tested with an experimental/analytical/theoretical program for measuring the dissolution kinetics of orthosilicate minerals for use in ionic modeling and molecular dynamics computer simulations of solid, aqueous solution, and solid/liquid interface. To date, dissolution rate have been measured for a suite of endmember and mixed-cation orthosilicate minerals (both olivine and willemite structures) as well as a few inosilicate minerals (pyroxenes). Dissolution rates appear to correlate well with solvent exchange rates around the hydrated divalent cations. Siloxane (Si-O-Si) bonds are relatively unreactive at low pH's close to zero point of neutral charge for quartz. The correlation suggests that silicic acid would be released from the reacting surfaces after protonation and hydration of bonds between divalent metals and structural oxygens; congruent dissolution is confirmed by Rutherford backscattered analysis of the near-surface of an acid-reacted forsterite. In the ionic modeling, except for liebenbergite, there is a general trend of increasing lattice energy with decreasing dissolution rate for endmember and mixed-cation orthosilicate minerals at pH 2. 3 figs, 4 refs.

4004 Electrochemistry

Refer also to citation(s) 32166, 32971

33337 (LA-UR–93-2196) **Kinetic studies of electrochemical generation of Ag(II) ion and catalytic oxidation of selected organics.** Zawodzinski, C.; Smith, W.H.; Martinez, K.R. Los Alamos National Lab., NM (United States). 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930571–24: 183. Electrochemical Society meeting, Honolulu, HI (United States), 16-21 May 1993). Order Number DE93016601. Source: OSTI; NTIS; INIS; GPO Dep.

The goal of this research is to develop a method to treat mixed hazardous wastes containing selected organic compounds and heavy metals, including actinide elements. One approach is to destroy the organic via electrochemical oxidation to carbon dioxide, then recover the metal contaminants through normally accepted procedures such as ion exchange, precipitation, etc. The authors have chosen to study the electrochemical oxidation of a simple alcohol, iso-propanol. Much of the recent work reported involved the use of an electron transfer mediator, usually the silver(I)/(II) redox couple. This involved direct electrochemical generation of the mediator at the anode of a divided cell followed by homogeneous reaction of the mediator with the organic compound. In this study the authors have sought to compare the mediated reaction with direct electrochemical oxidation of the organic. In addition to silver(I)/(II) they also looked at the cobalt(II)/(III) redox coupled. In the higher oxidation state both of these metal ions readily hydrolyze in aqueous solution to ultimately form insoluble oxide. The study concluded that in a 6M nitric acid solution at room temperature isopropanol can be oxidized to carbon dioxide and acetic acid. Acetic acid is a stable intermediate and resists further oxidation. The presence of Co(III) enhances the rate or efficiency of the reaction.

4005 Photochemistry

Refer also to citation(s) 32490, 33258, 33782

33338 (DOE/ER/14228–2) **Vibrational dynamics in photoinduced electron transfer: Progress report, December 1, 1992–November 30, 1993.** Spears, K.G. Northwestern Univ., Evanston, IL (United States). Dept. of Chemistry. 8 Sep 1993. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER14228. Order Number DE93040874. Source: OSTI; NTIS; GPO Dep.

Objective is to perform a new type of measurement for optically excited electron transfer processes that can provide unique experimental insight into the molecular mechanism of electron transfer. Measurements of optically excited electron transfer are done with picosecond infrared (IR) absorption spectroscopy to monitor the vibrational motions of the molecules immediately after electron transfer. Theory and experiment suggest that molecular vibrations and distortions are important controlling elements for electron transfer, and direct information has yet to be obtained on these elements of electron transfer mechanisms. The second period of funding has been dedicated to finishing technique development and performing studies of electron transfer in ion pair systems to identify if vibrational dependent electron transfer rates are present in this system. We have succeeded in measuring, for the first time, electron transfer rates as a function of vibrational state in an ion pair complex in solution. In a different area of electron transfer research we have proposed a new mechanism of solvent gated electron transfer.

33339 (LBL–34251) **Unimolecular photodissociation dynamics of ketene (CH_2CO): The singlet/triplet branching ratio and experimental observation of the vibrational level thresholds of the transition-state.** Kim, S.K. Lawrence Berkeley Lab., CA (United States). May 1993. 202p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93019252. Source: OSTI; NTIS; GPO Dep.

The rotational distributions of CO products from the dissociation of ketene at photolysis energies 10 cm^{-1} below, 56, 110, 200, 325, 425, 1,107, 1,435, 1,720, and 2,500 cm^{-1} above the singlet threshold, are measured in a supersonic free jet of ketene. The CO($v'' = 0$) rotational distributions at 56, 110, 200, 325, and 425 cm^{-1} are bimodal. The peaks at low J's, which are due to CO from the singlet channel, show that the product rotational distribution of CO product from ketene dissociation on the singlet surface is well described by phase space theory (PST). For CO($v'' = 0$) rotational distributions at higher excess energies, the singlet and triplet contributions are not clearly resolved, and the singlet/triplet branching ratios are estimated by assuming that PST accurately predicts the CO rotational distribution from the singlet channel and that the distribution from the triplet channel changes little from that at 10 cm^{-1} below the singlet threshold. At 2,500 cm^{-1} excess energy, the CO($v'' = 1$) rotational distribution is obtained, and the ratio of CO($v'' = 1$) to CO($v'' = 0$) products for the singlet channel is close to the variational RRKM calculation, 0.038, and the separate statistical ensembles (SSE) prediction, 0.041, but much greater than the PST prediction, 0.016. Rate constants for the dissociation of ketene (CH_2CO) and deuterated ketene (CD_2CO) have been measured at the threshold for the production of the $CH(D)_2$ and CO. Sharp peaks observed in photofragment excitation (PHOFEX) spectra probing CO ($v = 0$, $J = 2$) product are identified

with the C-C-O bending mode of the transition state. RRKM calculations are carried out for two limiting cases for the dynamics of K-mixing in highly vibrationally excited reactant states.

4006 Radiation Chemistry

Refer also to citation(s) 33158, 33913, 34484

33340 (LIU-TEK-LIC–1992-49) **Configuration of a pulse radiolysis system for the study of gas-phase reactions and kinetic investigations of the reactions of hydroxyl radicals with methyl and ethyl radicals.** Linkoeping Studies in Science and Technology. Fagerstroem, K. Linkoeping Univ. (Sweden). Dept. of Physics and Measurement Technology. Jan 1993. 21p. Order Number DE94600056. Source: OSTI; NTIS; INIS.

The work that is presented in this thesis deals with the assembling and testing of a pulse radiolysis system for kinetic studies of gas-phase reactions as well as with the kinetics of the gas-phase reactions of hydroxyl radicals with methyl and ethyl radicals. These radicals are very important as these are formed at an early stage in hydrocarbon combustion processes. The two studied reactions are key reactions in those processes. (6 refs., 4 figs., 2 tabs.).

4007 Radiochemistry and Nuclear Chemistry

Refer also to citation(s) 33185, 33287, 33334, 33867

33341 **Process for strontium-82 separation.** Heaton, R.C.; Jamriska, D.J. Sr.; Taylor, W.A. To Dept. of Energy. 1991. USA patent application 7-744,747. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93019335. Source: OSTI; NTIS; INIS; GPO Dep.

The process is for the selective separation of Sr-82 and Sr-85 from a proton-irradiated Mo target. It includes dissolving the Mo in H2O2 to form a solution which is then passed through a cationic resin, whereby Mo, Nb, Tc, Se, V, As, Ge, Zr, Rb ions remain in the solution, while Rb, Zn, Be, Co, Fe, Mn, Cr, Sr, Y, Zr ions are adsorbed. The resin is contacted with an acid solution to remove the adsorbed ions, forming a second solution. The second solution is evaporated and the residue dissolved in a dilute acid to form a third solution. After adjusting the acid molarity, the third solution is passed through a second cationic resin; this resin is contacted first with a dilute sulfuric acid solution and then with a dilute acid solution to remove the adsorbed Sr ions. Zr, Rb, and Y radioisotopes can also be recovered with additional steps.

4008 Combustion, Pyrolysis, and High-Temperature Chemistry

Refer also to citation(s) 32228, 32327, 32810, 33276, 33722, 33723, 33726, 33770, 33829

33342 (DOE/FTR–93017250) **Travel to Japan for collaborative research in modelling of flames: Foreign trip report, April 2–May 7, 1992.** Kee, R.J. Sandia National Labs., Livermore, CA (United States). 15 May 1992. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93017250. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of this 5-week trip, which began on April 2 and ended on May 7, was principally to pursue collaborative research with Prof. Tadao Takeno and his group at Nagoya University, Nagoya Japan. In addition to four weeks at Nagoya, Dr. Kee, spent one week in Tokyo, visiting Tokyo University and the Institute of Space and Astronautical Sciences. He also visited Toyota Central Research Laboratories, which is in the Nagoya area. Prof. Takeno's group, which consists of 3 assistant professors and about 12 graduate students, is active in the experimental and theoretical investigation of flame structure, including NOx and soot formation. Over the past five years, we have interacted frequently with Prof. Takeno on the analysis of a variety of strained flames. Prof. Takeno is a leading expert in this area and his work has had an important influence on the flame-modeling research at Sandia. In the course of the research at Nagoya, they have made some significant enhancements in the use of Sandia's Chemkin software. One of the objectives of the trip was to understand this work, and to bring the software, back to Sandia for our own research. The entire cost of this trip (with the exception of Dr. Kee's salary) was paid by the Japanese.

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Refer also to citation(s) 33986

33343 (DOE-HDBK–1018/2-93) **DOE fundamentals handbook: Mechanical science: Volume 2.** USDOE, Washington, DC (United States). Jan 1993. 123p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93012226. Source: OSTI; NTIS; GPO Dep.

The Mechanical Science Handbook was developed to assist nuclear facility operating contractors in providing operators, maintenance personnel, and the technical staff with the necessary fundamentals training to ensure a basic understanding of mechanical components and mechanical science. The handbook includes information diesel engines, heat exchangers, pumps, valves, and miscellaneous mechanical components. This information will provide personnel with a foundation for understanding the construction and operation of mechanical components that are associated with various DOE nuclear facility operations and maintenance.

33344 (UCRL-CR–105418) **Superpressure stratospheric vehicle: Final report, 11 September 1989 to 06 April 1990.** Rand, J.L. (Winzen International, Inc., San Antonio, TX (US)). Lawrence Livermore National Lab., CA (United States); Winzen International, Inc., San Antonio, TX (United States). 15 May 1990. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93019383. Source: OSTI; NTIS; GPO Dep.

This report describes work performed in the area of superpressure balloon engineering. The practical problem with superpressure balloons has been failures of the polyester films which served as the membranes for the balloon. They tended to develop pinholes, both in manufacture and in handling, and having low tear strength they could fail catastrophically from these pinholes. The paper describes the application of a new material to this technology. The material is a biaxially oriented nylon film, trade named Emblem®, and distributed in the US by Allied Signal Corporation. This material does not lend itself to heat sealing the seams during balloon manufacture, and the author describes a new technique designed to use with adhesive sealing of the balloon seams.

33345 (UCRL-CR–114810) **Integrated Product Development and Networking: Final report.** Gates, A.M. (TRW, Redondo Beach, CA (US). Spacecraft Technology Division); Young, W.K. Lawrence Livermore National Lab., CA (United States); TRW, Inc., Redondo Beach, CA (United States). Spacecraft Technology Div. [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93019631. Source: OSTI; NTIS; GPO Dep.

The purpose of the Integrated Product Development and Networking study was to research the spacecraft manufacturing processes at TRW Space and Electronics Group, and generate recommendations regarding the implementation of an automated spacecraft assembly system. TRW detailed in the previous interim report the current "As-Is" process in relation to the flow and dissemination of production and logistics data. The reports focused on current spacecraft assembly programs being performed at TRW Redondo Beach, specifically on the Brilliants Eyes and GPALS programs. The report identified: (1) the functional organizations and their inter-relationships, (2) current electronic information support systems, and (3) related automation tools, procedures and practices. This Final Report details the recommendations related to the implementation for an automated spacecraft assembly system.

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Refer also to citation(s) 32335, 32351, 32380, 32540, 32542, 32577, 32800, 32920, 33014, 33188, 33210, 33314, 33619, 33701, 33711, 33731, 33740, 33757, 34689

33346 (ANL/RE–93/3) **Free vibration analysis of partially filled liquid storage tanks.** Tang, Yu; Chang, Y.W. Argonne National Lab., IL (United States). May 1993. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93018933. Source: OSTI; NTIS; GPO Dep.

A study on the free vibration analysis of partially filled liquid storage tanks is presented. The tanks considered are the upright circular cylindrical tanks that are rigidly supported at the base. The top of the tanks are either free or constrained. Two types of constraints are considered, namely, hinged and roller support. The governing differential equations for the tank-liquid system are obtained by application of the Rayleigh-Ritz procedure in combination with Lagrange's equation. The response functions examined include the frequency of the fundamental mode of vibration of the tank-liquid system and the associated modal pressure.

33347 (ANL/RE–93/5) **Rocking response of tanks containing two liquids.** Tang, Yu; Chang, Y.W. Argonne National Lab., IL (United States). Jun 1993. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93018399. Source: OSTI; NTIS; GPO Dep.

Liquid storage tanks are important components of industrial facilities and, when located in earthquake prone regions, should be designed to withstand the earthquakes to which they may be subjected. There are cases in which the density of the tank content is not uniform. For such cases, the dynamic responses of tanks containing liquids with different densities must be studied. A study on the dynamic response of upright circular cylindrical liquid-storage tanks containing two different liquids under a rock base motion with an arbitrary temporal variation is presented. Only rigid tanks were studied. The response quantities examined include the hydrodynamic pressure, sloshing wave height and the associated frequencies, base shear and moments. Each of these response quantities is expressed as the sum of the so-called impulsive component and convective component. Unlike the case of tanks containing one liquid, in which the response is controlled by one parameter, height-to-radius ratio, the response of tanks containing two different liquids are controlled by three parameters: height-to-radius ratio, and mass density ratio and height ratio of the two liquids. The interrelationship of the responses of the tank-liquid system to rocking and lateral base excitations is established by examining numerical results extensively. It is found that some of the response quantities for a tank-liquid system under a rocking base motion can be determined from the corresponding response quantities for an identical tank under a horizontal base motion.

33348 (ANL/RE/CP–78822) **Seismic response of base-isolated buildings using a viscoelastic model.** Uras, R.A. Argonne National Lab., IL (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930803–24: 12. biennial conference for the International Association for Structural Mechanics in Reactor Technology (SMIRT 12), Stuttgart (Germany), 16-26 Aug 1993). Order Number DE93019541. Source: OSTI; NTIS; INIS; GPO Dep.

Due to recent developments in elastomer technology,seismic isolation using elastomer bearings is rapidly gaining acceptance as a design tool to enhance structural seismic margins and to protect people and equipment from earthquake damage. With proper design of isolators, the fundamental frequency of the structure can be reduced to a value that is lower than the dominant frequencies of earthquake ground motions. The other feature of an isolation system is that it can provide a mechanism for energy dissipation. In the USA, the use of seismic base-isolation has become an alternate strategy for advanced Liquid Metal-cooled Reactors (LMRs). ANL has been deeply involved in the development and implementation of seismic isolation for use in both nuclear facilities and civil structures for the past decade. Shimizu Corporation of Japan has a test facility at Tohoku University in Sendai, Japan. The test facility has two buildings: one is base isolated and the other is conventionally founded. The buildings are full-size, three-story reinforced concrete structures. The dimensions and construction of the superstructures are identical. They were built side by side in a seismically active area. In 1988, the ANL/Shimizu Joint Program was established to study the differences in behavior of base-isolated and ordinarily founded structures when subjected to earthquake loading. A more comprehensive description of this joint program is presented in a companion paper (Wang et al. 1993). With the increased use of elastomeric polymers in industrial applications such as isolation bearings, the importance of constitutive modeling of viscoelastic materials is more and more pronounced. A realistic representation of material behavior is essential for computer simulations to replicate the response observed in experiments.

33349 (CONF-9302103–3) **Modeling of single-crystal laser-weld microstructures.** Vitek, J.M. (Oak Ridge National Lab., TN (United States)); Zacharia, T.; David, S.A.; Boatner, L.A.; Rappaz, M. Oak Ridge National Lab., TN (United States). [1993]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Annual meeting of the Minerals, Metals and Materials Society (TMS); Denver, CO (United States); 21-25 Feb 1993. Order Number DE93017853. Source: OSTI; NTIS; GPO Dep.

A heat and fluid-flow model has been used to calculate the weld-pool size and shape for a high-speed, single-pass, autogenous laser weld as a function of time. Based on the calculated weld-pool shape, and with the use of a geometric model relating the dendritic growth to the weld-pool shape, the dendritic growth pattern was calculated for a single-crystal laser weld with an (001) surface that was welded along the [100] direction. The calculated results were compared to an actual experimental laser weld of an Fe-15Cr-15Ni alloy for the same orientation and weld direction. Agreement was obtained between the calculations and the experimental observations and the experimental dendritic growth pattern was accurately reproduced.

33350 (CONF-930907–8) **KENO-VI: A Monte Carlo Criticality Program with generalized quadratic geometry.** Hollenbach, D.F.; Petrie, L.M.; Landers, N.F. Oak Ridge National Lab., TN (United States). [1993]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From ANS topical meeting on physics and methods in criticality safety; Nashville, TN (United States); 19-23 Sep 1993. Order Number DE93017770. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses KENO-VI which is a new version of the KENO monte Carlo Criticality Safety developed at Oak Ridge National Laboratory. The purpose of KENO-VI is to provide a criticality safety code similar to KENO-V.a that possesses a more general and flexible geometry package. KENO-VI constructs and processes geometry data as sets of quadratic equations. A lengthy set of simple, easy-to-use geometric functions, similar to those provided in KENO-V.a., and the ability to build more complex geometric shapes represented by sets of quadratic equations are the heart of the geometry package in KENO-VI. The code's flexibility is increased by allowing intersecting geometry regions, hexagonal as well as cuboidal arrays, and the ability to specify an array boundary that intersects the array.

33351 (CONF-930907–9) **Fissile material storage in the Oak Ridge Radiochemical Development Facility.** Primm, R.T. III. Oak Ridge National Lab., TN (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From ANS topical meeting on physics and methods in criticality safety; Nashville, TN (United States); 19-23 Sep 1993. Order Number DE93018718. Source: OSTI; NTIS; INIS; GPO Dep.

As a part of a Department of Energy review of Oak Ridge National Laboratory facilities, nuclear safety documentation for the Radiochemical Development Facility (Building 3019) was found to be inadequate. While calculations existed which established safe limits for the storage of fissile material, these calculations were not performed with verified/validated software nor were the results reported in the manner prescribed by applicable DOE orders and ORNL procedures. To address this deficiency, the operations conducted in Building 3019 were reviewed and conditions were compared to available critical experiment data. Applicable critical experiments were selected and multiplication factors were calculated. Subcritical limits were derived for each of three fissile materials (U-233, U-235, and Pu-239). One application of these limits was to certify the safety of a storage array which could

contain any or all of the above nuclides at varying degrees of moderation. The studies presented are believed to fulfill most of the applicable regulatory requirements.

33352 (CONF-931160–17) **Shielded Canister Transporter.** Eidem, G.G. Jr.; Fages, R. Fluor Daniel, Inc., Irvine, CA (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-86RL10838. From American Nuclear Society (ANS) winter meeting; San Francisco, CA (United States); 14-19 Nov 1993. Order Number DE93019233. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Waste Vitrification Plant (HWVP) will produce canisters filled with high-level radioactive waste immobilized in borosilicate glass. This report discusses a Shielded Canister Transporter (SCT) which will provide the means for safe transportation and handling of the canisters from the Vitrification Building to the Canister Storage Building (CSB). The stainless steel canisters are 0.61 meters in diameter, 3.0 meters tall, and weigh approximately 2,135 kilograms, with a maximum exterior surface dose rate of 90,000 R/hr. The canisters are placed into storage tubes to a maximum of three tall (two for overpack canisters) with an impact limiter placed at the tube bottom and between each canister. A floor plug seals the top of the storage tube at the operating floor level of the CSB.

33353 (DOE/CE/15512–T8) **[An improved, more reliable and more marketable version of the Automatic Metering System].** Patas, J.E. Letco International, Inc., New Braunfels, TX (United States). [1993]. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-91CE15512. Order Number DE93016294. Source: OSTI; NTIS; GPO Dep.

Texas Research Institute Austin, Inc. (TRI/Austin) was tasked by Letco International to evaluate its Automatic Metering System (AMS), a proportional controller for heat tracing cable. The original objectives were focused primarily on the reliability of the AMS controller. However, from the time of the original TRI/Austin proposal, the AMS device evolved beyond the prototype level into an established market product with sufficient operational experience and data that product reliability evaluation was not a significant test objective. The goals of this effort have been to determine the relative energy usage of the AMS proportional control compared to existing thermostatic control in a realistic freeze protection installation (low temperature test), to perform an accelerated life test for self limiting heat tracing cables to determine the service life impact of AMS control vs. thermostat control, and to perform a reliability analysis of the AMS device according to the 1986 edition of MIL-HDBK-217E [1] specifications. TRI/Austin designed and constructed a test set-up for conducting the low temperature test and the accelerated life test. A conceptual diagram of the test hardware is shown in Figure 1. The control computer was programmed to monitor and collect data from both tests in parallel, using the relay box and control circuitry fabricated at TRI/Austin. Test data and control commands were transmitted to and from the computer via standard parallel and serial interfaces. The AMS controller and relay box switched the power to the test cables, the commercial freezer, and the ALT chamber.

33354 (DOE/FTR–93013560) **[Travel to England, Italy, France and Germany to conduct an evaluation of remote systems and robotics technology specifically applicable to the light-duty utility arm for use in underground storage tanks]: Foreign trip report, May 1–19, 1992.** Gilchrist, R.L.; Yount, J.A.; Raymond, R.E. Westinghouse Hanford Co., Richland, WA (United States). 1992. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93013560. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of this trip was to conduct an evaluation of remote systems and robotics technology in the United Kingdom, France, Italy, and Germany, specifically applicable to the light-duty utility arm for use in underground storage tanks. Additionally, an evaluation was to be performed on the readiness of specific French technology (e.g., surface barriers and characterization) for direct application to the UST-ID.

33355 (DOE/FTR–93014492) **Travel to Germany to attend First European Space Debris Conference: Foreign trip report, March 27–April 10, 1993.** Chhabildas, L.C.; Hertel, E.S. Sandia National Labs., Albuquerque, NM (United States). 7 May 1993. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93014492. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The primary purpose of the trip was to attend the First European Space Debris Conference, at Darmstadt, Germany. The European Conference was hosted by European Space Operation Center, ESOC, and the meeting was organized by Dr. Walter Flury. Lalit Chhabildas was invited to be the chairman on the technical session related to hypervelocity impact. Lalit Chhabildas and Gene Hertel presented papers on the use of experimental and computational techniques at Sandia to evaluate various single sheet Whipple bumper shield designs proposed for spacecraft. During this trip both Gene Hertel and Lalit Chhabildas visited the Ernst Mach Institut (EMI) in Freiburg, the Institut-fur Luft und Raumfahrt, Munich, the Institut fur Chirugische Forschung (ICF), Universitat Munchen, Munich, and the Institut fur Angewandte Physik (LAP), Darmstadt, Germany. These laboratories are actively performing state-of-the-art research on the dynamic properties of materials, including those of importance to current space programs at Sandia. They are also among the few labs in the forefront of studies on hypervelocity launcher developments, shock strength, and ballistic impact. A visit to these laboratories would give us an opportunity to get a first-hand look at their research programs and allow us to stay abreast of new developments in these areas. Similar research programs are also actively pursued at Sandia for a variety of applications. The laboratories ICF, Munich, and IAP, Darmstadt are renowned in the study of lithotripsy to fracture kidney stones and gallstones. This visit was made to explore the possibility of providing Sandia with a potential of using DOE technology for US medical applications.

33356 (DOE/FTR–93014796) **Participation in the NATO/AGARD symposium on theoretical and experimental methods in hypersonic flows in Turino, Italy: Foreign trip report, May 2–17, 1992.** Oberkampf, W.L. Sandia National Labs., Albuquerque, NM (United States). 22 Jun 1992. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93014796. Source: OSTI; NTIS (US Sales Only); GPO Dep.

William Oberkampf attended the Symposium on Theoretical and Experimental Methods in Hypersonic Flows sponsored by the NATO/AGARD Fluid Dynamics Panel. The theme of the Symposium was to "review the state of the art of high speed aerodynamic and thermodynamic design methods and achievements." The meeting was held in Turino, Italy, May 4–7, 1992 and was attended by 155 people. Forty-two papers were presented by researchers from 8 NATO nations, plus France; 14 papers were from the US. This Symposium is a specialty conference dealing with basic and applied research in numerical modeling and experimental methods for high speed gas dynamics. A paper was presented describing experimental and computational research that has been conducted at Sandia during the last three years. The Title of the paper was "Joint Computational and Experimental Aerodynamics Research on a Hypersonic Vehicle," authored by W. L. Oberkampf, D. P. Aeschliman, 1554, and M. A. Walker, 1511. After the Sandia paper was presented, several attendees commented that the Sandia research should serve as a model for wind tunnel experiments designed for CFD validation. The research clearly delineated between errors associated with mathematical modeling of the physical experiment, numerical accuracy for the given mathematical model, and experimental uncertainty of the data from the wind tunnel.

33357 (DOE/FTR–93015951) **Travel to United Kingdom to attend the 12th Aerodynamic Decelerator Systems Technology (ADST) conference, seminar, and post-conference technical tour: Foreign trip report, May 5–22, 1993.** Behr, V.; Hailey, C.; Macha, J.M.; McBride, D. Sandia National Labs., Albuquerque, NM (United States). 21 Jun 1993. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93015951. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of the trip was to support the ADST conference and seminar, to present technical papers, to hear technical papers presented by the conference attendees, and to enter into technical discussions with an international group of parachute system designers and analysts. Attached to this memo is the programme which describes the seminar, conference, post-conference technical tour, and authors of papers. Please note that photos of Vance Behr and Donald McBride appear on the first page of the programme since they are members of the ADST committee that organized the seminar and conference. Because of their involvement in setting up the seminar and conference, they met on Friday, May 7 in London. Christine Hailey attended the seminar on Monday, May 10, and presented papers at the conference. Behr, Hailey, and McBride also attended the post-conference technical tour of GQ Parachutes' facility near Bridgend, Wales.

33358 (DOE/RL/11978–T1-Vol.1) **Condition Assessment Survey (CAS) Program: Deficiency standards and inspections methods manual: Volume 1, 0.01 Foundations and footings.** Parsons Brinckerhoff Facilities Services, Inc., Herndon, VA (United States). May 1993. 235p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-91RL11978. Order Number DE93018424. Source: OSTI; NTIS; GPO Dep.

General information is presented for asset determinant factor/ CAS repair codes/CAS cost factors; guide sheet tool & material listing; testing methods; inspection frequency; standard system design life tables; system work breakdown structure; and general system/material data. Deficiency standards and inspection methods are given for footings - spread/strip/grade beams; foundation walls; foundation dampproofing/waterproofing; excavation/backfill/and piles & caissons.

33359 (DOE/RL/11978–T1-Vol.2) **Condition Assessment Survey (CAS) Program: Deficiency standards and inspections methods manual: Volume 2, 0.02 Substructure.** Parsons Brinckerhoff Facilities Services, Inc., Herndon, VA (United States). May 1993. 210p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-91RL11978. Order Number DE93018423. Source: OSTI; NTIS; GPO Dep.

System information is given for asset determinant factor/CAS repair codes/CAS cost factors; guide sheet tool & material listing; testing methods; inspection frequency; standard system design life tables; system work breakdown structure; and general system/ material data. System assembly/component deficiencies and inspection methods are given for slabs-on-grade, columns, and column fireproofing.

33360 (DOE/RL/11978–T1-Vol.3) **Condition Assessment Survey (CAS) Program: Deficiency standards and inspections methods manual: Volume 3, 0.03 Superstructure.** Parsons Brinckerhoff Facilities Services, Inc., Herndon, VA (United States). May 1993. 383p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-91RL11978. Order Number DE93018422. Source: OSTI; NTIS; GPO Dep.

General information is presented on asset determinant factor/ CAS profile codes/CAS cost process; guide sheet tool & material listing; testing methods; inspection frequency; standard system design life tables; system work breakdown structure; and general system/material data. Deficiency standards and inspection methods are presented for beams; pre-engineered building systems; floors; roof structure; stairs; and fireproofing.

33361 (DOE/RL/11978–T1-Vol.4) **Condition Assessment Survey (CAS) Program: Deficiency standards and inspections methods manual: Volume 4, 0.04 Exterior closure.** Parsons Brinckerhoff Facilities Services, Inc., Herndon, VA (United States). May 1993. 320p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-91RL11978. Order Number DE93018425. Source: OSTI; NTIS; GPO Dep.

General information is presented on asset determinant factor/ CAS repair codes/CAS cost factors; guide sheet tool & material listing; testing methods; inspection frequency; standard system design life tables; system work breakdown structure; and general system/material data. Deficiency standards and inspection data for walls, siding, exterior insulation & finish wall system, doors, windows & glazed walls, and paint finishes/coatings.

33362 (DOE/RL/11978–T1-Vol.5) **Condition Assessment Survey (CAS) Program: Deficiency standards and inspections methods manual: Volume 5, 0.05 Roofing.** Parsons Brinckerhoff Facilities Services, Inc., Herndon, VA (United States). May 1993. 324p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-91RL11978. Order Number DE93018426. Source: OSTI; NTIS; GPO Dep.

General information is presented for asset determinant factor/ CAS repair codes/CAS cost factors; guide sheet tool & material listing; testing methods; inspection frequency; standard system design life tables; and system work breakdown structure. Deficiency standards and inspection methods are presented for built-up membrane; single- ply membrane; metal roofing systems; coated foam membrane; shingles; tiles; parapets; roof drainage system; roof specialties; and skylights.

33363 (DOE/RL/11978–T1-Vol.6) **Condition Assessment Survey (CAS) Program: Deficiency standards and inspections methods manual: Volume 6, 0.06 Interior construction.** Parsons Brinckerhoff Facilities Services, Inc., Herndon, VA (United States). May 1993. 421p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-91RL11978. Order Number DE93018427. Source: OSTI; NTIS; GPO Dep.

General information is presented for asset determinant factor/ CAS repair codes/CAS cost factors; guide sheet tool & material listing; testing methods; inspection frequency; standard system design life tables; system work breakdown structure; and general system/material data. Deficiency standards and inspection methods are presented for conventional and specialty partitions, toilet partitions & accessories, interior doors, paint finishes/coatings/wall covering systems; floor finishing systems; and ceiling systems.

33364 (DOE/RL/11978–T1-Vol.7) **Condition Assessment Survey (CAS) Program: Deficiency standards and inspections methods manual: Volume 7, 0.07 Conveying.** Parsons Brinckerhoff Facilities Services, Inc., Herndon, VA (United States). May 1993. 203p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-91RL11978. Order Number DE93018428. Source: OSTI; NTIS; GPO Dep.

System information is given for asset determinant factor/CAS repair codes/CAS cost factors; guide sheet tool & material listing; testing methods; inspection frequency; standard system design life tables; and system work breakdown structure. Deficiency standards and inspection methods are presented for elevators and special conveyors.

33365 (DOE/RL/11978–T1-Vol.8-Bk.1) **Condition Assessment Survey (CAS) Program: Deficiency standards and inspections methods manual: Volume 8, 0.08 Mechanical, Book 1.** Parsons Brinckerhoff Facilities Services, Inc., Herndon, VA (United States). May 1993. 541p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-91RL11978. Order Number DE93018432. Source: OSTI; NTIS; GPO Dep.

System information is presented for asset determinant factor/ CAS repair codes/CAS cost factors; guide sheet too & material listing; testing methods; inspection frequency; standard system design life tables; and system work breakdown structure. Deficiency standards are given for plumbing, fire protection, heating, cooling, and special (drinking water cooling systems).

33366 (DOE/RL/11978–T1-Vol.8-Bk.2) **Condition Assessment Survey (CAS) Program: Deficiency standards and inspections methods manual: Volume 8, 0.08 Mechanical, Book 2.** Parsons Brinckerhoff Facilities Services, Inc., Herndon, VA (United States). May 1993. 321p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-91RL11978. Order Number DE93018431. Source: OSTI; NTIS; GPO Dep.

Inspection methods presented for plumbing, fire protection, heating, cooling, and special items (drinking water cooling systems).

33367 (DOE/RL/11978–T1-Vol.9-Bk.1) **Condition Assessment survey (CAS) Program: Deficiency standards and inspections methods manual: Volume 9, 0.09 Electrical, Book 1.** Parsons Brinckerhoff Facilities Services, Inc., Herndon, VA

(United States). May 1993. 324p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-91RL11978. Order Number DE93018430. Source: OSTI; NTIS; GPO Dep.

General information is presented for asset determinant factor/CAS repair codes/CAS cost factors; guide sheet tool & material listing; testing methods; inspection frequency; standard system design life tables; and system work breakdown structure. Deficiency standards are presented for service & distribution; lighting; and special systems.

33368 (DOE/RL/11978–T1-Vol.9-Bk.2) **Condition Assessment Survey (CAS) Program: Deficiency standards and inspections methods manual: Volume 9, 0.09 Electrical, Book 2.** Parsons Brinckerhoff Facilities Services, Inc., Herndon, VA (United States). May 1993. 217p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-91RL11978. Order Number DE93018429. Source: OSTI; NTIS; GPO Dep.

Inspection methods are presented for service & distribution, lighting, and special systems.

33369 (DOE/RL/11978–T1-Vol.11) **Condition Assessment Survey (CAS) Program: Deficiency standards and inspections methods manual: Volume 11, 0.11 Specialty systems.** Parsons Brinckerhoff Facilities Services, Inc., Herndon, VA (United States). May 1993. 219p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-91RL11978. Order Number DE93018433. Source: OSTI; NTIS; GPO Dep.

General information is presented for asset determinant factor/CAS repair codes/CAS cost factors; guide sheet tool & material listing; testing methods; inspection frequency; standard system design life tables; system work breakdown structure; and general system/material data. Deficiency standards and inspection methods are presented for canopies; loading dock systems; tanks; domes (bulk storage, metal framing); louvers & vents; access floors; integrated ceilings; and mezzanine structures.

33370 (DOE/RL/11978–T1-Vol.12) **Condition Assessment Survey (CAS) Program: Deficiency standards and inspections methods manual: Volume 12, 0.12 Sitework.** Parsons Brinckerhoff Facilities Services, Inc., Herndon, VA (United States). May 1993. 730p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-91RL11978. Order Number DE93018434. Source: OSTI; NTIS; GPO Dep.

General information is presented for asset determinant factor/CAS repair codes/CAS cost factors; guide sheet tool & material listing; testing methods; inspection frequency; standard system design life tables; system work breakdown structure; and general system/material data. Deficiency standards and inspection methods are given for utility distribution systems, central heating, central cooling, electrical, utility support structures, paving roadways/walkways, and tunnels.

33371 (EGG-M–93100) **Testing of ethylene propylene seals for the GA-4/GA-9 casks.** Boonstra, R.H. General Atomics, San Diego, CA (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC01-88ID12698. (CONF-930702–48: Pressure vessels and piping conference, Denver, CO (United States), 25-29 Jul 1993). Order Number DE93018948. Source: OSTI; NTIS; INIS; GPO Dep.

The primary O-ring seal of the GA-4 and GA-9 casks was tested for leakage with a full-scale mockup of the cask lid and flange. Tests were performed at temperatures of ambient, –41°, 121°, and 193°C. Shim plates between the lid and flange simulated gaps caused by thermal distortion. The testing used a helium mass spectrometer leak detector (MSLD). Results showed that the primary seal was leaktight for all test conditions. Helium permeation through the seal began in 13–23 minutes for the ambient tests and in 1–2 minutes for the tests at elevated temperatures. After each test several hours of the pumping were typically required to reduce the MSLD background reading to an acceptable level for the next test, indicating that the seal had become saturated with helium. To verify that the test results showed permeation and not real leakage, several response checks were conducted in which a calibrated leak source was inserted in the detector line near the seal. When the leak source was activated the detector responded within seconds.

33372 (ENEA-RT-DISP–91-04) **Reinforced concrete code ADINA.** Orsini, G. (ENEA, Rome (Italy). Direzione Sicurezza Nazionale e Protezione Sanitaria). 1992. 90p. (In Italian). (RT/DISP–91-04). Order Number DE93522957. Source: OSTI; NTIS (US Sales Only).

The analyses until failure of reinforced concrete structures, performed with the finite element method, require a realistic modelization of the materials behaviour. The effectiveness of such analyses and the correspondence of the obtained results to the actual structural behaviour strongly relies on the knowledge of the calculation tool used, both in the input phase and during results interpretation. This work constitues a contribution to the study of the behaviour of the ADINA Concrete Model and it is proposed as a tool to perform failure analyses of reinforced concrete structures.

33373 (HEDL-TC–2273) **Engineering evaluation of ruptured strainer in Building 309.** Papenfuss, J.N. Hanford Engineering Development Lab., Richland, WA (United States). Oct 1982. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93019984. Source: OSTI; NTIS; GPO Dep.

This report deals with the consequences of the ruptured steam strainer and is divided into two sections. Section 1 evaluates the engineering aspects of the ruptured steam strainer, investigates the events that culminated in the damage and considers factors that may have contributed to the incident. Recommendations are presented to upgrade the system in Building 309 by incorporating hardware changes and proposes a change in operating procedures. Section 2 utilizes the findings presented in Section 1 as a basis for conducting a review on the remainder of the 300 Area steam system, in order to identify similar problem areas. Corrective action recommendations to reduce the risk of repeating component ruptures from water hammer conditions were developed out of the survey and the associated review.

33374 (LA-SUB–93-241) **Confinement vessel analysis final report.** Lewis, B.B. (APTEK, Inc., Colorado Springs, CO (United States)). Los Alamos National Lab., NM (United States); APTEK, Inc., Colorado Springs, CO (United States). 6 May 1992. 125p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93018279. Source: OSTI; NTIS; GPO Dep.

The overall purpose of the confinement vessel analysis program was to aid Los Alamos in validation of a new confinement vessel configuration. This was done in two steps: First, we developed a finite element analysis model of the benchmark confinement vessel and compared the results against test results to verify the accuracy of the model and analysis technique. We then changed the finite element model to represent the new confinement vessel configuration and predicted the response of the new vessel for specified loading conditions. This report describes the work done to achieve the objective.

33375 (LA-UR–93-1938) **Smooth particle hydrodynamics: The SPHINX and SPHC codes.** Wingate, C.A.; Stellingwerf, R.F. Los Alamos National Lab., NM (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-931121–7: Annual winter meeting of the American Society of Mechanical Engineers, New Orleans, LA (United States), 28 Nov - 3 dec 1993). Order Number DE93014358. Source: OSTI; NTIS; GPO Dep.

Smooth Particle Hydrodynamics (SPH) is a new computational technique well suited to computation of hypervelocity impact phenomena. This paper reviews the characteristics, philosophy, and a bit of the derivation of the method. As illustrations of the technique, several test case computations and several application computations are shown.

33376 (LA-UR–93-2503) **An NDA system for automated inline weapons component dismantlement.** Sampson, T.E.; Cremers, T.L.; Martz, J.C.; Dworzak, W.R. Los Alamos National Lab., NM (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930749–38: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul

1993). Order Number DE93018374. Source: OSTI; NTIS; GPO Dep.

The Automated Retirement and Integrated Extraction System (ARMS) is a new development and demonstration glove-box line planned for installation at TA-55. The mission of ARIES is development of advanced technologies for disassembly of retired plutonium weapons components. ARIES is subdivided into the following subsystems: Receiving (airlock to system controlled atmosphere), Disassembly (parts are separated into hemishells), Plutonium Consolidation, Americium Removal, Decontamination (removal of trace plutonium from nonplutonium parts), and Nondestructive Assay (NDA). The ARIES NDA subsystem consists of four computer-based NDA instruments (calorimeter, gamma-ray isotopic system, segmented gamma scanner, and an active/passive neutron multiplicity counter); a robot to load and unload the instruments; and a host computer to sense and control the instrument status, schedule measurements, archive the results of the assays, and direct the activities of the robot. The NDA subsystem will be fully integrated into the ARIES process line and will provide assays of nuclear material that are inherently safer and more efficient than nonautomated systems.

33377 (LA-UR–93-2611) **A rational design change methodology based on experimental and analytical modal analysis.** Weinacht, D.J.; Bennett, J.G. Los Alamos National Lab., NM (United States). [1993]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9308138–1: 11. international invitational symposium on the unification of analytical, computational, and experimental solution methodologies, Danvers, MA (United States), 18-20 Aug 1993). Order Number DE93018537. Source: OSTI; NTIS; GPO Dep.

A design methodology that integrates analytical modeling and experimental characterization is presented. This methodology represents a powerful tool for making rational design decisions and changes. An example of its implementation in the design, analysis, and testing of a precisions machine tool support structure is given.

33378 (ORNL/CSD/FTR–4289) **Travel to France to chair meeting of the Criticality Calculations Working Group: Foreign trip report, June 17–19, 1992.** Whitesides, G.E. Oak Ridge National Lab., TN (United States). 6 Jul 1992. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93014309. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The traveler attended and chaired a meeting of the Organization for Economic Cooperation and Development's Nuclear Energy Agency (OECD NEA) Criticality Calculations Working Group. The current assignment for the Working Group is to establish the validity of criticality calculations for the storage and transportation of spent light water reactor (LWR) fuel in which credit is taken for the depletion of fissionable material and/or the build up of fission products. This meeting was held to review the results of the first work assignment and to plan the future work for the Working Group. Activities at the various critical experiment facilities were discussed as well as giving consideration to the establishment of an OECD-NEA Nuclear Critical Experiments Coordinating Committee.

33379 (ORNL/FTR–4616) **Travel to Japan to observe state of the art robotics in the apparel industry: Foreign trip report, May 7–15, 1993.** Jansen, J.F. Oak Ridge National Lab., TN (United States). 28 May 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93014663. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The Japanese International Apparel Machinery (JIAM) show in Tokyo was visited to observe the present state of the art of apparel equipment. In addition, we went to Brothers' corporate headquarters to observe their level of automation as an apparel equipment supplier. Specific equipment observations from the JIAM show are summarized in this report. Further, apparel industrial leaders from the United States summarized their findings at the show.

33380 (ORNL/FTR–4644) **Travel to Norway to present a paper at the 8th Scandanavian Conference on Image Analysis: Foreign trip report, May 23–31, 1993.** Jones, J.P. Oak Ridge National Lab., TN (United States). 14 Jun 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93017060. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report describes the traveler's attendance at the 1993 Scandinavian Conference on Image Analysis (SCIA) May 25 to 28, 1993, in Tromso, Norway. The traveler was invited to attend this conference and deliver a plenary lecture courtesy of The Norwegian Society for Image Processing and Pattern Recognition, The University of Tromso, and NORUT Information Technology Ltd. The traveler's role in the conference will be described, and a few specific highlights from the rest of the conference discussed.

33381 (ORNL/TM–12181) **Analysis and design of robust decentralized controllers for nonlinear systems.** Schoenwald, D.A. Oak Ridge National Lab., TN (United States). Jul 1993. 155p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93019224. Source: OSTI; NTIS; GPO Dep.

Decentralized control strategies for nonlinear systems are achieved via feedback linearization techniques. New results on optimization and parameter robustness of non-linear systems are also developed. In addition, parametric uncertainty in large-scale systems is handled by sensitivity analysis and optimal control methods in a completely decentralized framework. This idea is applied to alleviate uncertainty in friction parameters for the gimbal joints on Space Station Freedom. As an example of decentralized nonlinear control, singular perturbation methods and distributed vibration damping are merged into a control strategy for a two-link flexible manipulator.

33382 (ORNL/TM–12410) **Robot navigation in unknown terrains: Introductory survey of non-heuristic algorithms.** Rao, N.S.V. (Oak Ridge National Lab., TN (US)); Kareti, S.; Shi, Weimin; Iyengar, S.S. Oak Ridge National Lab., TN (United States). Jul 1993. 58p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93019221. Source: OSTI; NTIS; GPO Dep.

A formal framework for navigating a robot in a geometric terrain by an unknown set of obstacles is considered. Here the terrain model is not a priori known, but the robot is equipped with a sensor system (vision or touch) employed for the purpose of navigation. The focus is restricted to the non-heuristic algorithms which can be theoretically shown to be correct within a given framework of models for the robot, terrain and sensor system. These formulations, although abstract and simplified compared to real-life scenarios, provide foundations for practical systems by highlighting the underlying critical issues. First, the authors consider the algorithms that are shown to navigate correctly without much consideration given to the performance parameters such as distance traversed, etc. Second, they consider non-heuristic algorithms that guarantee bounds on the distance traversed or the ratio of the distance traversed to the shortest path length (computed if the terrain model is known). Then they consider the navigation of robots with very limited computational capabilities such as finite automata, etc.

33383 (ORNL/TM–12446) **Instrumentation and Controls Division, Technical Support Department Management Plan, FY 1993–FY 1996.** Adkisson, B.P.; Kunselman, C.W.; Effler, R.P.; Miller, D.R.; Millet, A.J.; Stansberry, C.T. Oak Ridge National Lab., TN (United States). Aug 1993. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93019205. Source: OSTI; NTIS; GPO Dep.

This report describes the organization, key functions, and major activities of the Technical Support Department The Department is the programmatic support element of the Instrumentation and Controls Division. The Department's primary focus is the support of existing equipment and systems at Oak Ridge National Laboratory that are generally characterized as instrumentation and controls. The support takes the form of repair, calibration, fabrication, field engineering, preventive maintenance, software support, and record keeping.

33384 **Apparatus for attaching a cleaning tool to a robotic manipulator.** Killian, M.A.; Zollinger, W.T. To Dept. of Energy. 1991. USA patent application 7-754,839. 19p. Sponsored by

USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93019322. Source: OSTI; NTIS; GPO Dep.

This invention is comprised of an apparatus for connecting a cleaning tool to a robotic manipulator so that the tool can be used in contaminated areas on horizontal, vertical and sloped surfaces. The apparatus comprises a frame and a handle, with casters on the frame to facilitate movement. The handle is pivotally and releasibly attached to the frame at a preselected position of a plurality of attachment positions. The apparatus is specifically configured for the KELLY VACUUM SYSTEM but can be modified for use with any standard mobile robot and cleaning tool.

33385 (PNL–8748) **PNL audit report/corrective action responses of Westinghouse Standards Laboratory.** Harrison, K.E.; Worden, L.M. Pacific Northwest Lab., Richland, WA (United States). Jun 1993. 58p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93018379. Source: OSTI; NTIS; GPO Dep.

This report is a collection of audit findings and corrective action responses to the Battelle Pacific Northwest Laboratory quality assurance verification of the Westinghouse Hanford Company (WHC) Standards Laboratory. Included in this document are meeting attendance records and copies of written correspondences concerning the audit. The document is roughly divided into three sections: a set of initial reports describing preparation of this corrective action document; reports pertaining to corrective action; and audit report records. Recent turnover of management at WHC Standards Laboratory was a contributing factor in completing this corrective action.

33386 (PNL-SA–21767) **Neural network applications in an Environmental and Molecular Sciences Laboratory.** Keller, R.E.; Kouzes, R.T.; Kangas, L.J. Pacific Northwest Lab., Richland, WA (United States). Jul 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG06-89ER75522 ;AC06-76RL01830. (CONF-930741–5: World congress on neural networks, Portland, OR (United States), 11-15 Jul 1993). Order Number DE93018794. Source: OSTI; NTIS; GPO Dep.

The construction of the Environmental and Molecular Sciences Laboratory (EMSL) at the Pacific Northwest Laboratory is currently in the planning stages. This facility will assist in the overall environmental restoration and waste management mission at the Hanford Site by providing basic and applied research support. This paper identifies several applications in the Envirorunental and Molecular Sciences Laboratory where neural network solutions can potentially be beneficial. These applications including real-time sensor data acquisition and analysis, spectral analysis, process control, theoretical modeling, and data compression.

33387 (PNL-SA–22041) **Damping control of a large flexible manipulator through inertial forces of a small manipulator.** Trudnowski, D.J.; Baker, C.P.; Evans, M.S. Pacific Northwest Lab., Richland, WA (United States). Jun 1993. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930663–2: American control conference (ACC), San Francisco, CA (United States), 2-4 Jun 1993). Order Number DE93018451. Source: OSTI; NTIS; GPO Dep.

Damping control is applied to a detailed computer model of a long- reach flexible manipulator test bed. The test bed consists of a long slender link with a dexterous manipulator mounted at its tip. The movement of the dexterous manipulator is controlled to create inertial damping forces on the long link. Parameter identification and sequential loop-closure are used to design a controller that feeds back relative tip position and velocity of the long link to control the azimuth angle of the dexterous manipulator. The controller is designed to be robust to varying manipulator loading conditions and reliable under sensor failures.

33388 (RFP–4719) **Human factoring the procedures element in a complex manufacturing system.** Caccamise, D.J.; Mecherikoff, M. EG and G Rocky Flats, Inc., Golden, CO (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC34-90DP62349. (CONF-9310100–2: Human Factors and Ergonomics Society meeting, Seattle, WA (United States), 11-15 Oct 1993). Order Number DE93015416. Source: OSTI; NTIS; GPO Dep.

As a result of Human Factors evaluations of procedures associated with incidents at Rocky Flats Plant (RFP) it was determined that the existing procedure format created significant opportunities for confusion in their attempt to convey information about a work process. For instance, there was no mechanism to clearly identify the participants and their roles during the instructions portion of the procedure. In addition, procedure authors frequently used complex logic to convey a series of contingent actions within steps. It was also difficult to discern the actual procedure steps from other types of information in the procedure. These and other inadequacies prompted the Human Factors Engineering (HFE) department to propose solutions to these problems that followed well-researched principles of cognitive psychology, dealing with how humans process information. Format and style contribute to procedure usability, and therefore to safety and efficiency in operations governed by the procedures. Since it was difficult to tie specific performance failures to specific format and style characteristics and thereby dearly define costs and benefits, it was difficult on that basis to sell the idea that changes in procedure format and style were really necessary to improve safety and efficiency. In addition, we found that the socio-political systems governing this process, particularly at the subprocess interface level, were not functioning efficiently. Both the technological aspects of the process and the socio-political aspects were contributing to waste and considerable re-work. Fixing the customer feedback loop to the process owners not only minimized re-work and waste, but also provided the data to persuade subprocess owners to make the necessary changes that heretofore were being met with great resistance.

33389 (SAND–92-0966) **Operations manual for the Beneficial Uses Shipping System cask: Revision 1.** Bronowski, D.R.; Yoshimura, H.R. Sandia National Labs., Albuquerque, NM (United States). Apr 1993. 158p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (TTC–1209). Order Number DE93018676. Source: OSTI; NTIS; GPO Dep.

This document is the Operations Manual for the Beneficial Uses Shipping System (BUSS) cask. These operating instructions address requirements; for loading, shipping, and unloading, supplementing general operational information found in the BUSS Safety Analysis Report for Packaging (SARP), SAND 83-0698. Use of the BUSS cask is authorized by Department of Energy (DOE) and Nuclear Regulatory Commission (NRC) for the shipment of special form cesium chloride or strontium flouride capsules.

33390 (SAND–92-0967) **Maintenance manual for the Beneficial Uses Shipping System cask: Revision 1.** Bronowski, D.R.; Yoshimura, H.R. Sandia National Labs., Albuquerque, NM (United States). May 1993. 182p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (TTC–1210). Order Number DE93018916. Source: OSTI; NTIS; GPO Dep.

This document is the Maintenance Manual for the Beneficial Uses Shipping System (BUSS) cask. These instructions address requirements for maintenance, inspection, testing, and repair, supplementing general information found in the BUSS Safety Analysis Report for Packaging (SARP), SAND 83-0698. Use of the BUSS cask is authorized by the Department of Energy (DOE) and the Nuclear Regulatory Commission (NRC) for the shipment of special form cesium chloride or strontium flouride capsules.

33391 (SAND–92-1864) **Characterization of the Facility for Atmospheric Corrosion Testing (FACT) at Sandia.** Greenholt, C.J.; Sorensen, N.R.; Poulter, G.A.; Guilinger, T.R. Sandia National Labs., Albuquerque, NM (United States). Jun 1993. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018510. Source: OSTI; NTIS; GPO Dep.

The capability to perform atmospheric corrosion testing of materials and components now exists at Sandia resulting from the installation of a system called the Facility for Atmospheric Corrosion Testing (FACT). This report details the design, equipment, operation, maintenance, and future modifications of the system. This report also presents some representative data acquired from testing copper in environments generated by the FACT.

33392 (SAND–92-2268C) **The continuing challenge of electromagnetic launch.** Cowan, M.; Cnare, E.C.; Duggin, B.W.;

Kaye, R.J.; Marder, B.M.; Shokair, I.R. Sandia National Labs., Albuquerque, NM (United States). [1993]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-931180–1: 6. international conference on megagauss magnetic field generation and related topics, Albuquerque, NM (United States), 8-11 Nov 1993). Order Number DE93017500. Source: OSTI; NTIS; GPO Dep.

Interest in launching payloads through the atmosphere to ever higher velocity is robust. For hundreds of years, guns and rockets have been improved for this purpose until they are now considered to be near to their performance limits. While the potential of electromagnetic technology to increase launch velocity has been known since late in the nineteenth century, it was not until about 1980 that a sustained and large-scale effort was started to exploit it. Electromagnetic launcher technology is restricted here to mean only that technology which establishes both a current density, J, and a magnetic field, B, within a part of the launch package, called the armature, so that J × B integrated over the volume of the armature is the launching force. Research and development activity was triggered by the discovery that high velocity can be produced with a simple railgun which uses an arc for its armature. This so called "plasma-armature railgun" has been the launcher technology upon which nearly all of the work has focused. Still, a relatively small parallel effort has also been made to explore the potential of electromagnetic launchers which do not use sliding contacts on stationary rails to establish current in the armature. One electromagnetic launcher of this type is called an induction coilgun because armature current is established by electromagnetic induction. In this paper, we first establish terminology which we will use not only to specify requirements for successful endoatmospheric launch but also to compare different launcher types. Then, we summarize the statuses of the railgun and induction coilgun technologies and discuss the issues which must be resolved before either of these launchers can offer substantial advantage for endoatomospheric launch.

33393 (SAND–92-2324) **Thermal test options.** Koski, J.A.; Keltner, N.R.; Sobolik, K.B. Sandia National Labs., Albuquerque, NM (United States). Feb 1993. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (TTC–1236). Order Number DE93019107. Source: OSTI; NTIS; INIS; GPO Dep.

Shipping containers for radioactive materials must be qualified to meet a thermal accident environment specified in regulations, such at Title 10, Code of Federal Regulations, Part 71. Aimed primarily at the shipping container design, this report discusses the thermal testing options available for meeting the regulatory requirements, and states the advantages and disadvantages of each approach. The principal options considered are testing with radiant heat, furnaces, and open pool fires. The report also identifies some of the facilities available and current contacts. Finally, the report makes some recommendations on the appropriate use of these different testing methods.

33394 (SAND–92-2401) **Use of a commercial heat transfer code to predict horizontally oriented spent fuel rod surface temperatures.** Wix, S.D. (Gram, Inc., Albuquerque, NM (US)); Koski, J.A. Sandia National Labs., Albuquerque, NM (United States). Mar 1993. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (TTC–1239). Order Number DE93018513. Source: OSTI; NTIS; INIS; GPO Dep.

Radioactive spent fuel assemblies are a source of hazardous waste that will have to be dealt with in the near future. It is anticipated that the spent fuel assemblies will be transported to disposal sites in spent fuel transportation casks. In order to design a reliable and safe transportation cask, the maximum cladding temperature of the spent fuel rod arrays must be calculated. A comparison between numerical calculations using commercial thermal analysis software packages and experimental data simulating a horizontally oriented spent fuel rod array was performed. Twelve cases were analyzed using air and helium for the fill gas, with three different heat dissipation levels. The numerically predicted temperatures are higher than the experimental data for all levels of heat dissipation with air as the fill gas. The temperature differences are 4°C and 23°C for the low heat dissipation and high heat dissipation, respectively. The temperature predictions using helium as a fill gas are lower for the low and medium heat dissipation levels, but higher at the high heat dissipation. The temperature differences are 1°C and 6°C for the low and medium heat dissipation, respectively. For the high heat dissipation level, the temperature predictions are 16°C higher than the experimental data. Differences between the predicted and experimental temperatures can be attributed to several factors. These factors include experimental uncertainty in the temperature and heat dissipation measurements, actual convection effects not included in the model, and axial heat flow in the experimental data. This work demonstrates that horizontally oriented spent fuel rod surface temperature predictions can be made using existing commercial software packages. This work also shows that end effects will be increasingly important as the amount of dissipated heat increases.

33395 (SAND–93-0242C) **Adaptive path planning: Algorithm and analysis.** Chen, Pang C. Sandia National Labs., Albuquerque, NM (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-931055–1: 6. international symposium of robotics research, Pittsburgh, PA (United States), 2 Oct 1993). Order Number DE93008348. Source: OSTI; NTIS; GPO Dep.

Path planning has to be fast to support real-time robot programming. Unfortunately, current planning techniques are still too slow to be effective, as they often require several minutes, if not hours of computation. To alleviate this problem, we present a learning algorithm that uses past experience to enhance future performance. The algorithm relies on an existing path planner to provide solutions to difficult tasks. From these solutions, an evolving sparse network of useful subgoals is learned to support faster planning. The algorithm is suitable for both stationary and incrementally-changing environments. To analyze our algorithm, we use a previously developed stochastic model that quantifies experience utility. Using this model, we characterize the situations in which the adaptive planner is useful, and provide quantitative bounds to predict its behavior. The results are demonstrated with problems in manipulator planning. Our algorithm and analysis are sufficiently general that they may also be applied to task planning or other planning domains in which experience is useful.

33396 (SAND–93-0559C) **Dependence of debris cloud formation on projectile shape.** Konrad, C.H. (Sandia National Labs., Albuquerque, NM (United States)); Chhabildas, L.C.; Boslough, M.B.; Piekutowski, A.J.; Poormon, K.L.; Mullin, S.A.; Littlefield, D.L. Sandia National Labs., Albuquerque, NM (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930676–11: 14. international conference of the International Association for the Advancement of High Pressure Science and Technology, Colorado Springs, CO (United States), 27 Jun - 2 jul 1993). Order Number DE93017895. Source: OSTI; NTIS; GPO Dep.

A two-stage light-gas gun has been used to impact thin zinc bumpers by zinc projectiles over the velocity range of 2.4 km/s to 6.7 km/s to determine the propagation characteristics of the impact generated debris. Constant-mass projectiles in the form of spheres, discs, cylinders and rods were used in these studies. Radiographic techniques were employed to record the debris cloud generated upon impact and the dynamic formation of the resulting rupture in an aluminum backing plate resulting from the loading of the debris cloud. The characteristics of the debris cloud generated upon impact is found to depend on the projectile shape. The data indicate that the debris front velocity is independent of the shape of the projectile, whereas the debris lateral/radial velocity is strongly dependent on projectile geometry. Spherical impactors generate the most radially dispersed debris cloud while the normal plate impactors result in column-like debris. It has been observed that the debris generated by the impact of thin plates on a thin bumper shield is considerably more damaging to a backwall than the debris generated by an equivalent-mass sphere.

33397 (SAND–93-0830) **A methodology for the evaluation of the turbine jet engine fragment threat to generic air transportable containers.** Harding, D.C.; Pierce, J.D. Sandia National

Labs., Albuquerque, NM (United States). Jun 1993. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (TTC–1258). Order Number DE93018690. Source: OSTI; NTIS; INIS; GPO Dep.

Uncontained, high-energy gas turbine engine fragments are a potential threat to air-transportable containers carried aboard jet aircraft. The threat to a generic example container is evaluated by probability analyses and penetration testing to demonstrate the methodology to be used in the evaluation of a specific container/aircraft/engine combination. Fragment/container impact probability is the product of the uncontained fragment release rate and the geometric probability that a container is in the path of this fragment. The probability of a high-energy rotor burst fragment from four generic aircraft engines striking one of the containment vessels aboard a transport aircraft is approximately 1.2×10^{-9} strikes/hour. Finite element penetration analyses and tests can be performed to identify specific fragments which have the potential to penetrate a generic or specific containment vessel. The relatively low probability of engine fragment/container impacts is primarily due to the low release rate of uncontained, hazardous jet engine fragments.

33398 (SAND–93-1495C) **The effects of initial conditions and control time on optimal actuator placement via a max-min Genetic Algorithm.** Redmond, J. (Sandia National Labs., Albuquerque, NM (United States)); Parker, G. Sandia National Labs., Albuquerque, NM (United States). [1993]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-931121–12: Annual winter meeting of the American Society of Mechanical Engineers, New Orleans, LA (United States), 28 Nov - 3 dec 1993). Order Number DE93017640. Source: OSTI; NTIS; GPO Dep.

This paper examines the role of the control objective and the control time in determining fuel-optimal actuator placement for structural vibration suppression. A general theory is developed that can be easily extended to include alternative performance metrics such as energy and time-optimal control. The performance metric defines a convex admissible control set which leads to a max-min optimization problem expressing optimal location as a function of initial conditions and control time. A solution procedure based on a nested Genetic Algorithm is presented and applied to an example problem. Results indicate that the optimal locations vary widely as a function of control time and initial conditions.

33399 (UCRL-CR–112568) **Report on the work "Nonparaxial MHD stabilizers for an axisymmetric magnetic mirror".** Ryutov, D. (Inst. of Nuclear Physics, Novosibirsk (RU)). Lawrence Livermore National Lab., CA (United States); AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki. Dec 1992. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93017996. Source: OSTI; NTIS; GPO Dep.

This report details the theoretical and experimental activity performed this month. The analysis of the MHD stability of flute perturbations in axisymmetric nonparaxial mirrors has been started. The preliminary screening has been completed of the possible candidates for a stabilizer. The experimental portion of the work commenced with preparations for experiments on the plasma equilibrium response to an externally applied small magnetic field in the MHD-anchor region. A brief discussion of the results of the preliminary experiments is provided. Plans for future studies are described.

33400 (UCRL-ID–114533) **Loft duct project report.** Reed, J.R. Lawrence Livermore National Lab., CA (United States). Jun 1993. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93018910. Source: OSTI; NTIS; GPO Dep.

On October 16, 1992, during a routine examination of the loft of Building 332, the Building Coordinator observed cracks in the welds of the duct work that services the fume hoods for Rooms 1313, 1321, and 1329. Further examination revealed cracks in the weld of the duct work that services the gloveboxes in Rooms 1321 and 1329. Upon discovery of the cracked welds, facility management immediately took the following two actions: Because one crack in the fume hood exhaust extended 70% around the duct circumference, a 1-ton chain fall was used to secure the duct to the roof support structure to prevent the duct from falling if the duct completely fractured. The Facility Manager suspended plutonium handling operations in the gloveboxes and work in the fume hoods in the affected rooms until the situation could be thoroughly investigated. Building 332 is ventilated by drawing conditioned air from the building hallways into the laboratories, hoods, and gloveboxes. This air is filtered through two sets of high-efficiency particulate air (HEPA) filters before being exhausted from the facility. Figure 1 is a schematic of the typical air flow pattern for the facility. All affected duct work is located in the loft of the facility or pressure zone 4. This ducting is fabricated from 12-, 14- and 16-gauge, 304 stainless-steel sheet stock and joined by the Gas Tungsten Arc Welding (GTAW) process.

33401 (UCRL-JC–110987) **Dynamic characterization of a lightweight, highly maneuverable spacecraft using modal and finite element analyses.** Manning, P.A.; Burdick, R.B.; Woehrle, T.G. Lawrence Livermore National Lab., CA (United States). Nov 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930241–2: 11. international modal analysis conference, Kissimmee, FL (United States), 1-4 Feb 1993). Order Number DE93018095. Source: OSTI; NTIS; GPO Dep.

The Lawrence Livermore National Laboratory is engaged in a technology development project which includes designing a lightweight, autonomous, highly maneuverable space vehicle, commonly referred to as a probe. The current probe design includes a guidance and control system that requires complete information on the dynamic response of the probe during operation. A finite element model of the probe was constructed to provide analytical information on the dynamic response to specific operational inputs. In order to verify the assumptions made in the model, a mass mock-up of the probe was constructed at LLNL and an experimental modal survey was performed to determine the frequencies, damping values and deflection shapes for each natural mode of the mock-up. The experimental modal parameters were compared with the parameters obtained through modal analysis of the finite element model to provide a measure of the correlation between the model and the actual structure. This report describes the experimental modal testing and analysis of the mass mock-up and compares the experimental results with the finite element results.

33402 (UCRL-JC–113750) **Impact velocity vs target hardness relationships for equivalent response of cask structures.** Chen, T.F.; Chen, J.C.; Witte, M.C.; Fischer, L.E. Lawrence Livermore National Lab., CA (United States). Jun 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930702–47: Pressure vessels and piping conference, Denver, CO (United States), 25-29 Jul 1993). Order Number DE93018626. Source: OSTI; NTIS; GPO Dep.

In this paper, impact velocity vs. target hardness relationships for cask structures are reviewed. The relationships are based on equivalent cask responses in terms of equal deceleration or similar cask damages. By examining several past cask or container tests as well as some analytical results, some conclusions can be drawn about the relationship between target hardness and equivalent impact velocities. This relationship clearly shows that the cask response to impact is cask-dependent and that the rigid sphere impact model results in an unconservative estimate of equivalent velocity.

33403 (UCRL-JC–113854) **Aerosol filtration with steel fiber filters.** Bergman, W.; Wilson, K.; Larsen, G.; Lopez, R. Lawrence Livermore National Lab., CA (United States). Apr 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9305166–3: American Filtration Society seminar and expo annual meeting, Chicago, IL (United States), 3-6 May 1993). Order Number DE93016990. Source: OSTI; NTIS; GPO Dep.

We have conducted an experimental study of aerosol penetration through a new high efficiency steel fiber filter and filter media that we developed in cooperation with Pall Corporation. Our previous studies have shown that sintered steel fiber media have significant improvements in higher filter efficiency and lower pressure drop

than the previous steel filter technology based on sintered powder metal media. In the present study, we have measured the penetration of dioctyl sebacate (DOS) aerosols through flat sheet samples, pleated cartridge filters and a 1000 cfm filter having 64 cartridges housed in a 2 × 2 × 1 ft. frame. The steel fiber media used in our study consists of 2 μm diameter stainless steel (316L) fibers sintered together into sheets.

33404 (WHC-MR–0423) **Westinghouse Hanford Company package testing capabilities.** Hummer, J.H.; Mercado, M.S. Westinghouse Hanford Co., Richland, WA (United States). Jul 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93019974. Source: OSTI; NTIS; INIS; GPO Dep.

The Department of Energy's Hanford Site is a 1,450-km^2 (560-mi^2) installation located in southeastern Washington State. Established in 1943 as a plutonium production facility, Hanford's role has evolved into one of environmental restoration and remediation. Many of these environmental restoration and remediation activities involve transportation of radioactive/hazardous materials. Packagings used for the transportation of radioactive/hazardous materials must be capable of meeting certain normal transport and hypothetical accident performance criteria. Evaluations of performance to these criteria typically involve a combination of analysis and testing. Required tests may include the free drop, puncture, penetration, compression, thermal, heat, cold, vibration, water spray, water immersion, reduced pressure, and increased pressure tests. The purpose of this paper is to outline the Hanford capabilities for performing each of these tests.

33405 (WSRC-TR–92-501) **Finite difference program for calculating hydride bed wall temperature profiles.** Klein, J.E. Westinghouse Savannah River Co., Aiken, SC (United States). 29 Oct 1992. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93019272. Source: OSTI; NTIS; INIS; GPO Dep.

A QuickBASIC finite difference program was written for calculating one dimensional temperature profiles in up to two media with flat, cylindrical, or spherical geometries. The development of the program was motivated by the need to calculate maximum temperature differences across the walls of the Tritium metal hydrides beds for thermal fatigue analysis. The purpose of this report is to document the equations and the computer program used to calculate transient wall temperatures in stainless steel hydride vessels. The development of the computer code was motivated by the need to calculate maximum temperature differences across the walls of the hydrides beds in the Tritium Facility for thermal fatigue analysis.

33406 (Y–2460) **A shear reversal nozzle for efficient gas atomization.** Brown, S.W. Oak Ridge Y-12 Plant, TN (United States). Dec 1992. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. Order Number DE93018391. Source: OSTI; NTIS; GPO Dep.

The primary purpose of this report is to establish definitive rationale and technical drivers for atomizing nozzles that employ the shear reversal principle. In a shear reversing nozzle, the liquid to be atomized is introduced into a supersonic gas flow and is allowed to accelerate to a velocity near that of the gas before it exits the nozzle. The pressure conditions at the exit of the nozzle are managed in such a manner to produce a strong normal shock wave in the gas flow field. The shock wave causes a large reduction in the gas velocity at the exit of the nozzle. Because the liquid is traveling near the initial gas velocity as it exits the nozzle, it now encounters a relatively slow moving gas flow field, which causes further reductions in the particle size. An elementary atomizing model is presented comprising two distinct processes: (1) particle divisions and (2) particle shearing. From the model, the primary process variables were identified and strategies were presented to maximize the production of fine diameter particles. In addition, an elementary finite difference model was presented to aid in the determination of the overall length of the shear reversing nozzle. Finally, a procedure was given to establish proper sizing of the components involved.

33407 **Variable speed pig for pipelines.** Campbell, D.C. 11 Nov 1992. Filed date 10 May 1991. Canada patent application 2042338. 25p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

Pigs, or devices propelled under gas or liquid pressure in a pipeline, may tow other tools such as analyzers or may stand alone for such tasks as cleaning. When used for towing smart pigs for analyzing conditions inside the pipeline, it is desirable that the pig maintain a constant pre-set speed. Accordingly, a variable speed pig is provided, comprising a housing having at least one flow-through passageway, an annular seal disposed about the housing for sealing engagement with the pipeline and the housing, and closure means for variably closing and opening the flow-through passageway. Means are disclosed for adjusting the closure means in response to variations in the speed of the pig in the pipeline, in order to maintain a desired speed of the pig. A method for controlling the speed of the pig preferably comprises preselecting a desired speed, comparing the actual and desired speeds, and decreasing or increasing the flow through the passageway when the actual speed is respectively lower or higher than the preselected speed. 7 figs.

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Refer also to citation(s) 32787, 33285, 33406, 33994

33408 (CONF-930675–6) **Influence of HX size and augmentation on performance potential of mixtures in air-to-air heat pumps.** Rice, C.K. Oak Ridge National Lab., TN (United States). May 1993. 37p. Sponsored by USDOE, Washington, DC (United States); Environmental Protection Agency, Washington, DC (United States). DOE Contract AC05-84OR21400. Agreement 1824-C019-A1. From 1993 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) summer meeting; Denver, CO (United States); 26-30 Jun 1993. Order Number DE93018603. Source: OSTI; NTIS; GPO Dep.

A modified Carnot analysis with finite heat exchanger (HX) sizes, counterflow HX configurations, and ideal glide matching was conducted for an air-to-air heat pump application. The purpose of the analysis was to determine the envelope of potential HX size and refrigerant-side augmentation benefits for ideal mixtures relative to pure refrigerant alternatives. The mixture COP benefits examined are those due to exact external fluid glide-matching of idealized mixtures in more effective heat exchangers. Maximum possible mixture COP gains are evaluated for four steady-state air-to-air heat pump conditions. Performance improvement opportunities are found to be primarily in the cooling mode. The effects of deviation from counterflow by use of crossflow and countercrossflow HX configurations are addressed. Refrigerant-side augmentation with pure and mixed refrigerants is examined for air-side dominant and air-to-refrigerant balanced HXs.

33409 (DOE/FTR–93014775) **Travel to England for Workshop on Two-Phase Flow Fundamentals: Foreign trip report, June 11–30, 1992.** Passman, S.L. Sandia National Labs., Albuquerque, NM (United States). 15 Jul 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93014775. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Stephen L. Passman acts as scientific advisor to the Solids Transport Program (STP) of DOE/PETC. As such, he is responsible for knowledge of state of the art developments in granular materials, multiphase flows, and related areas. The STP projects are part of the International Energy Agency (IEA) Programme of Research on Fossil Fuel Multiphase Flow Sciences. The purpose of this trip was to confer with outstanding experts in the international multiphase flow community, and to establish working relationships with management and participants in the U.K. portion of the IEA Programme.

33410 (ENEA-RT-NUCL–91-09) **Computer program for calculating two-dimensional transient dynamics of viscous incompressible fluid having free surface.** Barbaro, M. (ENEA,

Bologna (Italy). Centro Ricerche Energia 'E. Clemente!' - Area Nucleare). Jan 1993. 30p. (RT/NUCL–91-09). Order Number DE93522948. Source: OSTI; NTIS (US Sales Only).

This paper presents a computer program for calculating the two-dimensional transient dynamics of viscous incompressible fluids having a free surface. With this program, the Navier-Stokes equations are solved by a solution algorithm based on the Volume-of-Fluid (VOF) method. The program is applied as an example to the classical broken-dam problem. The results are compared critically with available experimental data.

33411 (IFE/KR/E–93/004) **Multidimensional modeling of industrial multiphase flows.** Bendiksen, K. Institutt for Energiteknikk, Kjeller (Norway). Jun 1993. 49p. Order Number DE93525281. Source: OSTI; NTIS.

The considerable research and development effort over the last decades, particularly within the nuclear and petroleum industries, has produced several one-dimensional (1D) two-phase flow models for prediction on flow regime, pressure drop temperature and liquid fraction distribution in a large variety of pipeline systems. This type of transient models, supported by extensive large scale data bases have, in fact, been established as design tools within the petroleum industry. Industrial requirements regarding three-dimensional (3D) multiphase flow modeling are rapidly changing. Consequently it is important to incorporate new physical models into more general-purpose computer codes with interactive, graphical pre- and post-processors. As there is no general-purpose model available, covering all or most relevant applications, a lot of "tailoring" is performed. The ability to treat complex geometries, using general body-fitted non-orthogonal coordinates, already permits most industrial problems to be "modeled". The limiting factor is now on the detailed physical models applied, their relevance in a given problem and their verification. Available 3D models are not able to properly describe coalescence, breakup, deposition or surface wetting by liquids. The treatment of multiparticle, in particular droplet systems require, in addition, improved detailed (3D) experimental data on size and tear-off velocity distributions. However, although clearly incomplete and empirically closed, current 3D two-phase flow models are being increasingly applied in designing various types of flow equipment, optimizing metallurgical processes, and estimating environmental consequences of different accidents and spills. Improved instrumentation and more powerful work-stations will certainly accelerate this development. 62 refs., 38 figs., 1 tab.

33412 (KAPL–4747) **Measurement of local void fraction at elevated temperature and pressure.** Duncan, D.; Trabold, T.A. Knolls Atomic Power Lab., Schenectady, NY (United States). Mar 1993. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC12-76SN00052. (CONF-931087–1: 3. world conference on experimental heat transfer, fluid mechanics and thermodynamics, Honolulu, HI (United States), 31 Oct - 5 nov 1993). Order Number DE93013220. Source: OSTI; NTIS; INIS; GPO Dep.

Significant advances have recently been made in analytical and computational methods for the prediction of local thermal-hydraulic conditions in gas/liquid two-phase flows. There is, however, a need for extensive experimental data, for the dual purposes of constitutive relation development and code qualification. There is especially true of systems involving complicated geometries and/or extreme flow conditions for which little, if any, applicable information exists in the open literature. For the tests described in the present paper, a novel electrical probe has been applied to measure the void fraction in atmospheric pressure air/water flows, and steam/water mixtures at high temperature and pressure. The data acquired in the latter experiments are compared with the results of a one-dimensional two-fluid computational analysis.

33413 (LA–12536-MS) **Implementation of the Turn Function Method in KIVA-F90.** O'Rourke, P.J.; Fairfield, M.S. Los Alamos National Lab., NM (United States). Aug 1993. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93018394. Source: OSTI; NTIS; GPO Dep.

We document the implementation of the Turn Function Method (TFM) in KIVA-F90, a version of the KIVA computer program written in the FORTRAN 90 programming language that is used on some massively parallel computers. TFM solves both linear momentum and vorticity equations in numerical calculations of compressible fluid flow. Solving a vorticity equation allows vorticity to be both conserved and transported more accurately than is possible in traditional methods for computing compressible flow. To calculate the convective transport of vorticity more accurately, we have also implemented an improved method for the rezone phase of the KIVA computational cycle. This first implementation of TFM in a three-dimensional hydrodynamics code involved some modification of the original method and some novel numerical difference approximations. In particular, we used a penalty method to keep the divergence of the computed vorticity field close to zero. Also, difference operators are defined in such a way that the finite difference analog of $\nabla \cdot (\nabla \times u) = 0$ is exactly satisfied. Three example problems presented in this report show the greater accuracy that can be gained when TFM is used for calculations of flows with rotational motion, as well as the added computational costs incurred. Use of the method can increase by 60% the computational times of the Euler equation solver in KIVA-F90. Although TFM sometimes does degrade accuracy in calculations that have large vorticity gradients, generally the calculations show beneficial effects of TFM on accuracy. We will continue to evaluate the costs and benefits of TFM in future KIVA-F90 calculations.

33414 (LA-UR–93-1056) **Liquid resupply effects in macrolayer-controlled nucleate boiling.** Sadasivan, P.; Unal, C.; Nelson, R.A. Los Alamos National Lab., NM (United States). [1993]. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-931121–3: Annual winter meeting of the American Society of Mechanical Engineers, New Orleans, LA (United States), 28 Nov - 3 dec 1993; N–6-93-R113). Order Number DE93011273. Source: OSTI; NTIS; GPO Dep.

Previous studies of the high-heat-flux nucleate boiling regime have made widely varying assumptions about the state of the macrolayer at the beginning of the hovering period of the mushroom bubbles overlying the macrolayer. The uncertainty in the initial state of the macrolayer is largely because little is known about the nature of liquid resupply to the near-heater area following the departure of the mushroom bubble. An assessment of the effect of the differences in liquid resupply mechanisms by experimental means is extremely difficult because of the microscopic length and time scales involved. The present study investigates this using numerical means. A transient three-dimensional computer program was developed and used to simulate various possible resupply mechanisms and consequently different possible initial temperature profiles in the macrolayer. The results show that in commonly used heater materials such as copper, the initial temperature profile in the macrolayer has very little effect on the boiling curve (surface- andtime-averaged heat flux and temperature). For higher average surface temperatures observed for low-thermal-conductivity heater materials such as nickel, the boiling curve could shift by a few degrees depending on the initial thermal profile in the macrolayer. Initial thickness of the macrolayer does have an effect on the boiling curve for small values of initial thickness; however, for large initial thicknesses, the effect on the boiling curve is small. It also is shown that changes in the time elapsed between replenishment of the macrolayer (hovering period) do not affect the boiling curve significantly as long as localized dryout of the macrolayer does not occur.

33415 (LA-UR–93-1057) **The effect of heater material and thickness on the saturated pool nucleate boiling curve.** Pasamehmetoglu, K.O.; Unal, C. Los Alamos National Lab., NM (United States). [1993]. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-931121–2: Annual winter meeting of the American Society of Mechanical Engineers, New Orleans, LA (United States), 28 Nov - 3 dec 1993; N–6-93-R114). Order Number DE93010731. Source: OSTI; NTIS; INIS; GPO Dep.

The heater effects on the saturated nudeate pool boiling curve were investigated using a previously developed numerical model. Two generally used heater materials, copper and nickel, were considered for heater thicknesses varying from 0.012 to 4 mm. A parametric study is presented to identify the most influential parameters. Results show that for a given heat flux, the nucleate boiling

heat-transfer coefficient (HTC) for a copper heater is higher than the HTC for a nickel heater. Furthermore, the difference between the boiling curves for copper and nickel is a function of the surface topography. In general, the boiling curve for a given heater material shifts to the left with decreasing heater thickness. This result agrees with most of the available studies, with the exception of one. Our analysis also shows that, for rougher surfaces over a nickel heater, there is an increase in the HTC with decreasing heater thickness. Reducing the bubble departure diameter with decreasing thickness in our simulations, we were able to more clearly observe the increasing trend of the HTC with decreasing heater thicknesses for relatively rough surfaces.

33416 (LA-UR–93-1058) **Numerical modeling of the effect of surface topology on the saturated pool nucleate boiling curve.** Unal, C.; Pasamehmetoglu, K.O. Los Alamos National Lab., NM (United States). [1993]. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-931121–1: Annual winter meeting of the American Society of Mechanical Engineers, New Orleans, LA (United States), 28 Nov - 3 dec 1993; N–6-93-R109). Order Number DE93010730. Source: OSTI; NTIS; INIS; GPO Dep.

A numerical study of saturated pool nucleate boiling with an emphasis on the effect of surface topography is presented. The numerical model consisted of solving the three-dimensional transient heat conduction equation within the heater subjected to nucleate boiling over its upper surface. The surface topography model considered the distribution of the cavity and cavity angles based on exponential and normal probability functions. Parametric results showed that the saturated nucleate boiling curve shifted left and became steeper with an increase in the mean cavity radius. The boiling curve was found to be sensitive to the selection of how many cavities were selected for each octagonal cell. A small variation in the statistical parameters, especially cavity radii for smooth surfaces, resulted in noticeable differences in wall superheat for a given heat flux. This result indicated that while the heat transfer coefficient increased with cavity radii, the cavity radii or height alone was not sufficient to characterize the boiling curve. It also suggested that statistical experimental data should consider large samples to characterize the surface topology. The boiling curve shifted to the right when the cavity angle was obtained using a normal distribution. This effect became less important when the number of cavities for each cell was increasing because the probability of the potential cavity with a larger radius in each cell was increased. When the contact angle of the fluid decreased for a given mean cavity radii, the boiling curve shifted to the right. This shift was more pronounced at smaller mean cavity radii and decreased with increasing mean cavity radii.

33417 (LA-UR–93-2656) **Regenerator optimization for Stirling cycle refrigeration.** Colgate, S.A. (Los Alamos National Lab., NM (United States)); Petschek, A.G. Los Alamos National Lab., NM (United States). [1993]. 47p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930703–15: International cryogenic engineering conference and international cryogenic materials conference, Albuquerque, NM (United States), 12-16 Jul 1993). Order Number DE93018468. Source: OSTI; NTIS; GPO Dep.

A cryogenic regenerator for a Stirling cycle is designed using a fractional loss or entropy gain as the criterion of performance. The gas losses are treated separately from heat storage medium losses. For the optimum channel flow nonturbulent design, the maximization of heat transfer from the gas to the wall and the minimization of entropy production by friction leads to a gas flow velocity criterion of sound speed times loss fraction. This velocity with a given frequency leads to a Stirling cycle dead volume ratio and consequently a channel of specified length and width. The thermal properties of the channel wall must then accommodate this cyclic heat flow without substantially increasing the loss fraction. It is found that stainless steel or plastics are adequate for 30 to 300 K, but that lower temperature stages 4 to 30 K require either a special lead alloy of moderate conductivity or a segmented anisotropic construction of alternate highly conducting lead layers and alternate insulating glass or epoxy fiber glass spacers. An overall efficiency of ≅ 50% of Carnot is predicted at a frequency of 30 Hz and a pressure of one atmosphere.

33418 (LIU-TEK-LIC–1993-09) **Numerical solution of pipe flow problems for generalized Newtonian fluids.** Linkoeping Studies in Science and Technology. Samuelsson, K. Linkoeping Univ. (Sweden). Dept. of Mathematics. 4 Mar 1993. 67p. Order Number DE94600234. Source: OSTI; NTIS; INIS.

In this work we study the stationary laminar flow of incompressible generalized Newtonian fluids in a pipe with constant arbitrary cross-section. The resulting nonlinear boundary value problems can be written in a variational formulation and solved using finite elements and the augmented Lagrangian method. The solution of the boundary value problem is obtained by finding a saddle point of the augmented Lagrangian. In the algorithm the nonlinear part of the equations is treated locally and the solution is obtained by iteration between this nonlinear problem and a global linear problem. For the solution of the linear problem we use the SSOR preconditioned conjugate gradient method. The approximating problem is solved on a sequence of adaptively refined grids. A scheme for adjusting the value of the crucial penalization parameter of the augmented Lagrangian is proposed. Applications to pipe flow and a problem from the theory of capacities are given. (author) (34 refs.).

33419 (PNL-SA–21173) **Ensemble averaging applied to the flow of a multiphase mixture.** Liljegren, L.M. Pacific Northwest Lab., Richland, WA (United States). Jun 1993. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930621–4: American Society of Mechanical Engineers (ASME) fluids engineering conference, Washington, DC (United States), 20-24 Jun 1993). Order Number DE93017979. Source: OSTI; NTIS; INIS; GPO Dep.

Ensemble averaging theorems are used to derive a two-fluid model describing the flow of a dilute fluid-solid mixture. The model is valid for mixtures containing particles that are small compared to the length scales describing variations in ensemble-averaged field quantities, such as fluid or particle phase density, pressure or velocity. For the case where the mixture is pseudo-homogeneous, the equations obtained reproduce the Einstein viscosity correction.

33420 (SAND–93-0186C) **Numerical solutions for a flow with mixed convection in a vertical geometry.** Torczynski, J.R. Sandia National Labs., Albuquerque, NM (United States). [1993]. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-931121–5: Annual winter meeting of the American Society of Mechanical Engineers, New Orleans, LA (United States), 28 Nov - 3 dec 1993). Order Number DE93011592. Source: OSTI; NTIS; GPO Dep.

The K-12 Aerospace Heat Transfer Committee of the American Society of Mechanical Engineers recently specified a computational benchmark problem involving steady incompressible laminar flow with mixed convection using the Boussinesq approximation in a two-dimensional backstep geometry. FIDAP v6.0 (Fluid Dynamics International) and NEKTON v2.85 (Nektonics, Fluent) are capable of simulating situations with this type of coupled fluid flow and heat transfer. FIDAP uses conventional finite elements and has both steady and transient solvers, whereas NEKTON uses spectral elements with a transient solver (for large problems). Numerical solutions to the benchmark problem are obtained with both of these codes, and grid-refinement studies are performed to verify that grid-independence is achieved. The grid-independent solutions from both codes are found to be in excellent agreement with each other and with results in the archival literature regarding velocity and temperature profiles and the locations of separation and reattachment points.

33421 (UCRL-CR–113693) **Dense gas boundary layer experiments: Visualization, pressure measurements, concentration evaluation.** Reichenbach, H. (Ernst-Mach-Institut, Freiburg (DE)); Neuwald, P.; Kuhl, A.L. Lawrence Livermore National Lab., CA (United States); Ernst Mach Inst., Freiburg (Germany); R and D Associates, Los Angeles, CA (United States). Nov 1992. 65p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-48. Contract DNA 001-91-C-0039. Order Number DE93019608. Source: OSTI; NTIS; GPO Dep.

This technical report describes methods that were applied to investigate turbulent boundary layers generated by inviscid, baroclinic effects. The Cranz-Schardin 24-sparks camera was used to visualize the interactions of a planar shock wave with a Freon R12-layer. The shock propagates more slowly in the Freon layer than in air because of its smaller sound speed. This causes the shock front to be curved and to be reflected between the wall and the layer interface. As a consequence of the reflection process, a series of compression and expansion waves radiate from the layer. Large fluctuations in the streamwise velocity and in pressure develop for about 1 ms. These waves strongly perturb the interface shear layer, which rapidly transitions to a turbulent boundary flow. Pressure measurements showed that the fluctuations in the Freon layer reach a peak pressure 4 times higher than in the turbulent boundary flow. To characterize the preshock Freon boundary layer, concentration measurements were performed with a differential interferometry technique. The refraction index of Freon R12 is so high that Mach-Zehnder interferometry was not successful in these experiments. The evaluation of the concentration profile is described here in detail. Method and results of corresponding LDV measurements under the same conditions are presented in a different report, EMI Report T 9/92. The authors plan to continue the dense gas layer investigations with the gas combination helium/Freon.

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Refer also to citation(s) 33017, 33116, 33197, 33242, 33265, 33313, 33372, 33402, 33602

33422 (ANL/MCT/CP–76064) **Development and application of local 3-D x-ray CT reconstruction software for imaging critical regions in large ceramic turbine rotors.** Sivers, E.A. (Argonne National Lab., IL (United States)); Holloway, D.L.; Ellingson, W.A.; Ling, J. Argonne National Lab., IL (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-920799–8: Review of progress in quantitative nondestructive evaluation (NDE), La Jolla, CA (United States), 19-24 Jul 1992). Order Number DE93015159. Source: OSTI; NTIS; GPO Dep.

Current 3-D X-ray CT imaging technology is limited in some cases by the size and sensitivity of the X-ray detector. This limitation can be overcome to some degree by the use of region-of-interest (ROI) reconstruction software when only part of a larger object need be examined. However, images produced from ROI data often exhibit severe density shading if they are reconstructed by unaltered 3-D X-ray CT algorithms (called Global methods here). These density artifacts can be so severe that low-contrast features are hidden. Time-consuming methods introduced previously to remedy these artifacts require specialized processing to replace or approximate the missing data outside the desired volume. Although these methods are required for true densitometry measurements, in many NDT applications only the detection of internal features or relative density variations is required. In such cases, the use of Local (or Lamda) X-ray CT, which produces an "edge-enhanced" reconstruction and requires only minor modifications of the standard 3-D X-ray CT algorithm, is recommended. Since the primary difference between Global and Local CT concerns the design of the convolution filter, two versions of a Local CT fitter are discussed here. These two filters are used in a Local CT implementation to reconstruct 3D X-ray CT data. For comparison, Global CT using the Shepp-Logan variation of the fan-beam convolution fitter is used to reconstruct the same data. This comparison shows the relative merits of Local and Global CT for fairly noisy scans of large, green Si_3N_4 pressure-slip-cast parts. The Feldkamp modification of fan-beam CT reconstruction is used in the reconstructions. In each case, real-number, reconstructed images are scaled linearly to optimize the available grey-scale levels in the images presented here.

33423 (INIS-mf–13549, pp. 86-91) **Experimental equipment for reactor measurement of relaxation characteristics of materials.** Grinik, Eh.U. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Karasev, V.S.; Orlinskij, A.B. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 10.* 214p. Order Number DE94600067. Source: OSTI; NTIS (US Sales Only); INIS.

The new apparatus used for in-reactor determination of internal friction, shear modulus and creep of materials are described. The principal element of the device is a measuring pendulum placed in an ampoule controlled by a remote electronic data system. The specimen to be measured is fixed firmly to the ampoule bottom. The internal friction, shear modulus and creep data are continuously registered by recorders. 3 refs.; 2 figs. (author).

33424 (LA-UR–93-2468) **Liquid sound speeds at pressure from the optical analyzer technique.** Fritz, J.N.; Morris, C.E.; Hixson, R.S.; McQueen, R.G. Los Alamos National Lab., NM (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930676–14: 14. international conference of the International Association for the Advancement of High Pressure Science and Technology, Colorado Springs, CO (United States), 27 Jun - 2 jul 1993). Order Number DE93018362. Source: OSTI; NTIS; GPO Dep.

The optical analyzer technique has proved to be a useful means of obtaining wave velocities at high pressures. Stepped wedges of the investigated material emit shock, and later, rarefaction waves into a transparent analyzer covering the material. The time interval between shock and rarefaction plotted versus wedge thickness gives a linear plot whose intercept fixes the target/driver thickness ratio for exact wave overtake, and thus gives a relation between the shock velocity and overtaking wave velocity at pressure. The slope of this line is intimately related to the wave velocity at pressure of the analyzer in front of the wedge. This aspect of the technique has not yet been exploited. We present the appropriate analysis, some data on bromoform (one of the analyzers used), and discuss some possible applications of this technique.

33425 (LA-UR–93-2802) **Simulation of dynamic material response with the PAGOSA code.** Holian, K.S.; Adams, T.F. Los Alamos National Lab., NM (United States). [1993]. 5p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-931121–13: Annual winter meeting of the American Society of Mechanical Engineers, New Orleans, LA (United States), 28 Nov - 3 dec 1993). Order Number DE93018285. Source: OSTI; NTIS; GPO Dep.

The 3D Eulerian PAGOSA hydrocode is being run on the massively parallel Connection Machine (CM) to simulate the response of materials to dynamic loading, such as by high explosives or high velocity impact. The code has a variety of equation of state forms, plastic yield models, and fracture and fragmentation models. The numerical algorithms in PAGOSA and the implementation of material models are discussed briefly.

33426 A method for the thermal characterization, visualization, and integrity evaluation of conducting material samples or complex structures. Ortiz, M.G. To Dept. of Energy. 1991. USA patent application 7-739,376. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93019338. Source: OSTI; NTIS; GPO Dep.

This invention is useful in thermal imaging of conducting materials, and is particularly useful in measuring thermal conductivity and thermal boundary conditions in composite anisotropic materials, in materials of irregular shape, and in materials for high-temperature applications. It also has utility in visualizing the integrity of complex structures such as a machine, power plant, or chemical plant. The method is for modeling a conducting material sample or structure (system) as an electrical network of resistances, for measuring electric resistance between selected leads attached to the surface of the system, and, using basic circuit theory, for translating measured resistances into temperatures or indications of integrity in corresponding regions of the system. 10 figs.

33427 (SAND–93-0418C) **Target response to debris cloud incidence.** Kipp, M.E. Sandia National Labs., Albuquerque, NM (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930676–12: 14. international conference of the International Association for the Advancement of High Pressure Science and Technology, Colorado Springs, CO (United States), 27 Jun - 2 jul 1993). Order Number DE93017873. Source: OSTI; NTIS; GPO Dep.

The extent of penetration and/or perforation of a target layer by a debris cloud, whose particle mass distribution and velocities were calculated from a previous impact, was determined with two computational approaches. First, the size of single or paired particles required for target perforation was calculated and compared with the largest particle expected based on the fragment size distribution in the debris cloud. A second approach used a three-dimensional shock-wave code to calculate the explicit interaction of individual particles in the debris cloud with the target. The cloud was represented by randomly locating the particles within an envelope, maintaining the mass and size distribution of the particles. This interaction of the cloud of particles produced target surface craters and penetration comparable to recovered witness plates from impact experiments.

33428 (UCRL-JC–111856) **Single sided tomography of extremely large dense objects.** Thoe, R.S. Lawrence Livermore National Lab., CA (United States). 24 Mar 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930445–19: Society of Photo-Optical Instrumentation Engineers (SPIE) OE/aerospace science and sensing meeting, Orlando, FL (United States), 11-16 Apr 1993). Order Number DE93017993. Source: OSTI; NTIS; GPO Dep.

One can envision many circumstances where radiography could be valuable but is frustrated by the geometry of the object to be radiographed. For example, extremely large objects, the separation of rocket propellants from the skin of solid fuel rocket motor, the structural integrity of an underground tank or hull of a ship, the location of buried objects, inspection of large castings etc. The author has been investigating ways to do this type of radiography and as a result has developed a technique which can be used to obtain three dimensional radiographs using Compton scattered radiation from a monochromatic source and a high efficiency, high resolution germanium spectrometer. This paper gives specific details of the reconstruction technique and presents the results of numerous numerical simulations and compares these simulations to spectra obtained in the laboratory. In addition the author presents the results of calculations made for the development of an alternative single sided radiography technique which will permit inspection of the interior of large objects. As a benchmark the author seeks to obtain three dimensional images with a resolution of about one cubic centimeter in a concrete cube 30 centimeters on a side. Such a device must use photons of very high energy. For example 30 cm of concrete represents about 15 mean free paths for photons of 100 keV, whereas at 1 MeV the attenuation is down to about five mean free paths. At these higher energies Compton scattering becomes much more probable. Although this would appear to be advantageous for single sided imaging techniques, such techniques are hampered by two side effects. In this paper the results are given of numerous Monte Carlo calculations detailing the extent of the multiple scattering and the feasibility of a variety of imaging schemes is explored.

33429 (UCRL-JC–113742) **Dual-band infrared thermography for quantitative nondestructive evaluation.** Durbin, P.F.; Del Grande, N.K.; Dolan, K.W.; Perkins, D.E.; Shapiro, A.B. Lawrence Livermore National Lab., CA (United States). Apr 1993. 11p. Sponsored by USDOE, Washington, DC (United States); Federal Aviation Administration, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9304189–3: 1993 joint Army, Navy, NASA, Air Force (JANNAF) nondestructive evaluation subcommittee meeting, Livermore, CA (United States), 26-28 Apr 1993). Order Number DE93019151. Source: OSTI; NTIS; GPO Dep.

The authors have developed dual-band infrared (DBIR) thermography that is being applied to quantitative nondestructive evaluation (NDE) of aging aircraft. The DBIR technique resolves 0.2 degrees C surface temperature differences for inspecting interior flaws in heated aircraft structures. It locates cracks, corrosion sites, disbonds or delaminations in metallic laps and composite patches. By removing clutter from surface roughness effects, the authors clarify interpretation of subsurface flaws. To accomplish this, the authors ratio images recorded at two infrared bands, centered near 5 microns and 10 microns. These image ratios are used to decouple temperature patterns associated with interior flaw sites from spatially varying surface emissivity noise. They also discuss three-dimensional (3D) dynamic thermal imaging of structural flaws using dual-band infrared (DBIR) computed tomography. Conventional thermography provides single-band infrared images which are difficult to interpret. Standard procedures yield imprecise (or qualitative) information about subsurface flaw sites which are typically masked by surface clutter. They use a DBIR imaging technique pioneered at LLNL to capture the time history of surface temperature difference patterns for flash-heated targets. They relate these patterns to the location, size, shape and depth of subsurface flaws. They have demonstrated temperature accuracies of 0.2°C, timing synchronization of 3 ms (after onset of heat flash) and intervals of 42 ms, between images, during an 8 s cooling (and heating) interval characterizing the front (and back) surface temperature-time history of an epoxy-glue disbond site in a flash-heated aluminum lap joint.

33430 (UCRL-JC–114935) **A methodology for assessing high intensity RF effects in aircraft.** Zacharias, R.A.; Avalle, C.A.; Kunz, K.S.; Molau, N.E.; Pennock, S.T.; Poggio, A.J.; Sharpe, R.M. Lawrence Livermore National Lab., CA (United States). Jul 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9310142–1: Institute for Electrical and Electronics Engineers/American Institute of Aeronautics and Astronautics (IEEE/AIAA) digital avionics systems conference and technical display, Ft. Worth, TX (United States), 25-28 Oct 1993). Order Number DE93018097. Source: OSTI; NTIS; GPO Dep.

Optical components have an inherent immunity to the electromagnetic interference (EMI) associated with High Intensity Radiated Fields (HIRF). The optical technology embodied in Fly-by-Light (FBL) might therefore minimize the effects of HIRF on digitally controlled systems while providing lifetime immunity to signal EMI. This is one of the primary motivations for developing FBL systems for aircraft. FBL has the potential to greatly simplify EMI certification by enabling technically acceptable laboratory tests of subsystems, as opposed to expensive full airplane tests. In this paper the authors describe a methodology for assessing EMI effects on FBL aircraft that reduces or potentially eliminates the need for full airplane tests. This methodology is based on comparing the applied EMI stress–the level of interference signal that arrives at a unit under test–versus the EMI strength of the unit–the interference level it can withstand without upset. This approach allows one to use computer models and/or low power coupling measurement and similarity (to other previously tested aircraft) to determine the stress applied to installed subsystems, and to use benchtop cable injection tests and/or mode stirred chamber radiated tests to determine the strength of the subsystem.

4210 Combustion Systems

Refer also to citation(s) 32407, 34652

33431 **Combustion apparatus.** Booth, G.; Donnelly, S.; Lindley, B. 23 Nov 1992. Filed date 22 May 1991. Canada patent application 2043040. 14p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

An improved design of incinerator is provided which is capable of essentially complete combustion of waste material such as scrap tires. A combustion apparatus is disclosed which comprises a combustion chamber for effecting primary combustion of combustible material charged into the chamber, an exhaust conduit for gases emitted by the primary combustion, primary air inlet means for directing primary air into the combustion chamber, and secondary air inlet means for directing secondary air into the exhaust conduit. The secondary air is directed at least in the region adjacent the combustion chamber so as to promote further combustion of the exhaust gases. The secondary air inlet means includes an air distributor arranged centrally of the conduit characterized in that secondary air inlets are additionally provided in the wall of the conduit over at least part of the extent of the air distributor. 4 figs.

33432 **Controlled pyrolysis of scrap tire by EPF [earth pollution free].** Pietruczuk, J. 23 Nov 1992. Filed date 22 May 1991. Canada patent application 2043169. 15p. Source: Micromedia Ltd.,

Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

A pollution free system for pyrolysis of scrap tires is disclosed, comprising four parts: a kiln, a cooling system, a soot separation unit, and a smoke treatment unit. The kiln is a vertical unit lined with brick, having gas burners and a grate for holding the tires. A screw feeder at the bottom of the kiln removes uncombusted materials for recycling. The cooling unit consists of metal pipes running through a metal container and cooled by water. The soot is removed by a filter bag system and the gases exiting this unit are treated by a lime-spraying scrubber. 25 figs.

4220 Mining and Underground Engineering

Refer also to citation(s) 32394, 32395

33433 **Derrick assembly capable of conveying pipe sections between a drill string and a rack for said pipe sections.** Rowbotham, R.H.; Cassady, G.T. 17 Nov 1992. Filed date 16 May 1991. Canada patent application 2042723. 21p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

Conventional procedures for lengthening or shortening a string of drill tubing at a well require a derrick rig and an operator to transfer and store pipe sections. This procedure is inefficient and can be occupationally dangerous. Accordingly, a derrick assembly is provided for automatically conveying pipe sections between a drill string and a storage rack for the pipe sections. The assembly includes a frame having lateral sidewalls and a base together defining an elongated channel having an open outer side opposite to the base. A rack for housing pipe sections is positioned within the channel adjacent to one lateral sidewall, leaving part of the channel clear for manipulating the drill string. The rack is formed by a number of elements extending between the base and the open outer side for housing pipe sections oriented generally longitudinally within the channel. A gantry extends across the open outer side of the channel and is movable longitudinally of the channel. The gantry supports a pipe gripping unit for selectively gripping or releasing pipe sections and for conveying pipe sections between the rack and the clear part of the channel by appropriate movements towards or away from the base and laterally between the sidewalls. In the preferred forms of the invention, the pipe sections are preferably double lengths and are stowed in the derrick frame itself, being manipulated entirely by power devices between the drill string and the storage station. 15 figs.

33434 **Working member of a helical downhole motor for drilling wells.** Kochnev, A.; Vshivkov, A.N.; Goldobin, V.B.; Korotaev, J.A. To Permsky Filial Vsesojuznogo Nauchno-Issledovatelskogo Inst. Burovoi Tekhniki (USSR). 6 Sep 1992. Filed date 5 Mar 1991. Canada patent application 2037553. 16p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN.

A stator or rotor of a helical downhole motor for drilling oil and gas wells comprises separate sections having helical teeth arranged in succession one after another and interconnected by rings. Each ring has helical teeth coinciding in pitch and direction with the pitch and direction of the helical teeth of the sections, and equidistant in profile. Preferably, each ring has a wall of continuous or variable thickness. The arrangement of the teeth, rings, and sections according to the invention is such that the moment of force is transmitted through the mating toothed helical surfaces engaging with each other through the entire contour of their lateral and axial sections. As a result, the large area of engagement between the mating helical surfaces of the sections of the rotor or stator and rings connecting the sections ensures low stresses in the joint, and consequently a high reliability of the connection. Provision of the connecting element in the form of a ring with a wall of continuous thickness makes it possible to reduce the mass of the rotor or stator and simplify its manufacture. 7 figs.

4230 Marine Engineering

Refer also to citation(s) 34665, 34666

33435 (NEI-NO–356) **A computer vision system for an autonomous underwater vehicle.** Hallset, J.O. Trondheim Univ. (Norway). Norges Tekniske Hoegskole. Nov 1992. 162p. Order Number DE93525288. Source: OSTI; NTIS.

This thesis describes a vision system for the PISCIS project. It is a proposed project for the use of an untethered autonomous underwater vehicle (AUV) for pipeline inspection. The vision system is termed PVS (the PISCIS vision system). It will assist the AUV in finding and following pipelines. The PVS will use a camera to continuously find the position and heading of pipelines relative to the AUV. A salient feature of the PVS is that it is designed to find all pipelines within the field of view and, thus, the AUV can follow any of them. The positions and headings are used in a control loop to move the vehicle to a chosen pipeline. They are also used to keep the vehicle over this pipeline during the inspection. Robust image interpretation is important as humans can not interact with the PVS and correct errors. Furthermore, the image quality is reduced by backscatter from the water, light absorption, a non-uniform background (the sea-bed), and marine material on the pipelines. The PVS is fixed to a moving vehicle and must rely on a heading sensor and an altitude sonar to match images features with pipeline models. The models are retrieved from a map based on the vehicle's position. The PVS is tested with images taken in air in the laboratory. The images have, like underwater images, highly varying contrast, "pipelines" with a broken outline, and a non-uniform scene background. The conclusion is that the PVS can interpret moderately complex pipeline-configurations even when the vehicle's position is inaccurate. A real-life system must function over a wide range of image acquisition conditions; the PVS is shown to be robust against vehicle pitch-, roll-, and heading-errors, scaling errors, and a skewed light source. 99 refs., 83 figs., 14 tabs.

4250 Power Cycles

Refer also to citation(s) 33408

4260 Components, Electron Devices and Circuits

Refer also to citation(s) 32745, 33015, 33016, 33017, 33068, 33142, 33237, 33272, 33280, 33517, 33601, 33646, 33693, 33706, 34436, 34522, 34530, 34531, 34532, 34533, 34625

33436 (ENEA-RT-INN–92-29) **Novel solution for design of electrode profiles of discharge lasers.** Di Lazzaro, P. (ENEA, Frascati (Italy). Centro Ricerche Energia - Area Energia e Innovazione); Giordano, G.; Mezi, L.; Zheng, C. Jan 1993. 15p. (RT/INN–92-29). Order Number DE93522943. Source: OSTI; NTIS (US Sales Only).

The influence of the current return parts on electric field uniformity in discharge laser chambers is studied, and a novel mixed solution for better electrode profiles, giving lower electric field spatial gradients, is presented.

33437 (ETDE-IT–93-204) **Optical coatings for improving laser beam quality.** Piegari, A. (ENEA, Casaccia (Italy). Dipt. Tecnologie Intersettoriali di Base); Scaglione, S.; Emiliani, G. 1993. 11p. (CONF-9209295–2: Society of Photo Optical Instrumentation Engineers (SPIE/EOS) international symposium on optical design systems, Berlin (Germany), 14-19 Sep 1992). Order Number DE93522954. Source: OSTI; NTIS (US Sales Only).

Thin film coatings having a radially variable reflectance with a circular symmetry are used for obtaining diffraction limited laser beams from unstable resonators. Different approaches are used for the design of such coatings with a consequent different final coating structure that will contain one or more profiled thickness layers. Some design methods are discussed with reference to reflected intensity and phase profiles and the fabrication techniques for coatings at different wavelengths are illustrated.

33438 (LA-UR–93-2623) **Foil support structure for large electron guns.** Brucker, J.P.; Rose, E.A. Los Alamos National Lab., NM (United States). [1993]. 5p. Sponsored by USDOE,

Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930616–18: 9. IEEE pulsed power conference, Albuquerque, NM (United States), 21-23 Jun 1993). Order Number DE93018478. Source: OSTI; NTIS; GPO Dep.

This paper describes a novel support structure for a vacuum diode used to pump a gaseous laser with an electron beam. Conventional support structures are designed to hold a foil flat and rigid. This new structure takes advantage of the significantly greater strength of metals in pure tension, utilizing curved shapes for both foil and support structure. The shape of the foil is comparable to the skin of a balloon, and the shape of the support structures is comparable to the cables of a suspension bridge. This design allows a significant reduction in foil thickness and support structure mass, resulting in a lower electron-beam loss between diode and laser gas. In addition, the foil is pre-formed in the support structure at pressures higher than operating pressure. Therefore, the foil is operated far from the yield point. Increased reliability is anticipated.

33439 (PNL-SA–21852) **Operational parameters of an opto-electronic neural network employing fixed planar holographic interconnects.** Keller, P.E. (Pacific Northwest Lab., Richland, WA (United States)); Gmitro, A.F. Pacific Northwest Lab., Richland, WA (United States). Jul 1993. 5p. Sponsored by Arizona Univ., Tucson, AZ (United States). DOE Contract AC06-76RL01830. (CONF-930741–4: World congress on neural networks, Portland, OR (United States), 11-15 Jul 1993). Order Number DE93018795. Source: OSTI; NTIS; GPO Dep.

A prototype neutral network system of multifaceted, planar interconnection holograms and opto-electronic neurons is analyzed. This analysis shows that a hologram fabricated with electron-beam lithography has the capacity to connect 6700 neuron outputs to 6700 neuron inputs and that the encoded synaptic weights have a precision of approximately 5 bits. Higher interconnection densities can be achieved by accepting a lower synaptic weight accuracy. For systems employing laser diodes at the outputs of the neurons, processing rates in the range of 45 to 720 trillion connections per second can potentially be achieve.

33440 (SAND–93-0145C) **The Lever oscillator for use in high resistance resonator applications.** Wessendorf, K.O. Sandia National Labs., Albuquerque, NM (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9306205–1: 1993 Institute of Electrical and Electronic Engineers (IEEE) frequency control symposium, Salt Lake City, UT (United States), 2-4 Jun 1993). Order Number DE93017652. Source: OSTI; NTIS; GPO Dep.

The Lever oscillator has been specifically designed for use with quartz resonator sensors. The use of quartz resonators as sensors is of particular interest and depending on the sensing environment, e.g., liquid, the oscillator design is both critical and difficult due to the wide dynamic range of resonator resistance possible due to damping of the resonator. Standard oscillator designs do not work well as sensor oscillators. An oscillator design will be presented that allows both frequency and loss (R_m) of the resonator to be determined over a wide dynamic range of resonator loss. The Lever oscillator uses negative feedback in a differential amplifier configuration to actively and variably divide (or leverage) the resonator impedance such that the oscillator can maintain the phase and gain of the loop over a wide range of resonator resistance.

33441 (SAND–93-1006C) **Design and testing of planar magnetic micromotors fabricated by deep x-ray lithography and electroplating.** Guckel, H. (Wisconsin Univ., Madison, WI (United States). Dept. of Electrical and Computer Engineering); Christenson, T.R.; Skrobis, K.J.; Klein, J.; Karnowsky, M. Sandia National Labs., Albuquerque, NM (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract AC04-76DP00789. Grant EET-8815285;Grant 88-MC-507;Grant N00014-91-J-1876;Grant D (CONF-9305186–1: 7. international conference on solid state sensors and actuators, No City Given (Japan), 13-15 May 1993). Order Number DE93012856. Source: OSTI; NTIS; GPO Dep.

The successful design and testing of a three-phase planar integrated magnetic micromotor is presented. Fabrication is based on a modified deep X-ray lithography and electroplating or LIGA process. Maximum rotational speeds of 33,000 rpm are obtained in air with a rotor diameter of 285 μm and do not change when operated in vacuum. Real time rotor response is obtained with an integrated shaft encoder. Long lifetime is evidenced by testing to over $5(10)^7$ ration cycles without changes in performance. Projected speeds of the present motor configuration are in the vicinity of 100 krpm and are limited by torque ripple. Higher speeds, which are attractive for sensor applications. require constant torque characteristic excitation as is evidenced by ultracentrifuge and gyroscope design. Further understanding of electroplated magnetic material properties will drive these performance improvements.

33442 (SAND–93-1063C) **Wetting behavior of alternative solder alloys.** Hosking, F.M.; Vianco, P.T.; Hernandez, C.L.; Rejent, J.A. Sandia National Labs., Albuquerque, NM (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9309195–1: Static memory interface conference, San Jose, CA (United States), 1 Sep 1993). Order Number DE93016730. Source: OSTI; NTIS; GPO Dep.

Recent economic and environmental issues have stimulated interest in solder alloys other than the traditional Sn-Pb eutectic or near eutectic composition. Preliminary evaluations suggest that several of these alloys approach the baseline properties (wetting, mechanical, thermal, and electrical) of the Sn-Pb solders. Final alloy acceptance will require major revisions to existing industrial and military soldering specifications. Bulk alloy and solder joint properties are consequently being investigated to validate their producibility and reliability. The work reported in this paper examines the wetting behavior of several of the more promising commercial alloys on copper substrates. Solder wettability was determined by the meniscometer and wetting balance techniques. The wetting results suggest that several of the alternative solders would satisfy pretinning and surface mount soldering applications. Their use on plated through hole technology might be more difficult since the alloys generally did not spread or flow as well as the 60Sn-40Pb solder.

33443 (SAND–93-1414C) **Solderability perservative coatings: Electroless tin vs. organic azoles.** Artaki, I. (AT and T Bell Labs., Princeton, NJ (United States)); Ray, U.; Jackson, A.M.; Gordon, H.M.; Vianco, P.T. Sandia National Labs., Albuquerque, NM (United States). [1993]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9308126–2: Surface Mount Technical Association international conference, San Jose, CA (United States), 31 Aug - 2 sep 1993). Order Number DE93017634. Source: OSTI; NTIS; GPO Dep.

This paper compares the solderability performance and corrosions ion protection effectiveness of electroless tin coatings versus organic azole films after exposure to a series of humidity and thermal (lead-free solders) cycling conditions. The solderability of immersion tin is directly related to the tin oxide growth on the surface and is not affected by the formation of Sn-Cu intermetallic phases as long as the intermetallic phase is protected by a Sn layer. For a nominal tin thickness of 60μinches, the typical thermal excursions associated with assembly are not sufficient to cause the intermetallic phase to consume the entire tin layer. Exposure to humidity at moderate to elevated temperatures promotes heavy tin oxide formation which leads to solderability loss. In contrast, thin azole films are more robust to humidity exposure; however upon heating in the presence of oxygen, they decompose and lead to severe solderability degradation. Evaluations of lead-free solder pastes for surface mount assembly applications indicate that immersion tin significantly improves the spreading of Sn:Ag and Sn:Bi alloys as compared to azole surface finishes.

33444 (SAND–93-1474C) **High current density contacts for photoconductive semiconductor switches.** Baca, A.G.; Hjalmarson, H.P.; Loubriel, G.M.; McLaughlin, D.L.; Zutavern, F.J. Sandia National Labs., Albuquerque, NM (United States). 1993. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930616–22: 9. IEEE pulsed power conference, Albuquerque, NM (United States), 21-23 Jun 1993). Order Number DE93018837. Source: OSTI; NTIS; GPO Dep.

The current densities implied by current filaments in GaAs photoconductive semiconductor switches (PCSS) are in excess of 1 MA/cm^2. As the lateral switches are tested repeatedly, damage accumulates at the contacts until electrical breakdown occurs across the surface of the insulating region. In order to improve the switch lifetime, the incorporation of n- and p-type ohmic contacts in lateral switches as well as surface geometry modifications have been investigated. By using p-type AuBe ohmic contacts at the anode and n-type AuGe ohmic contacts at the cathode, contact lifetime improvements of 5–10x were observed compared to switches with n-type contacts at both anode and cathode. Failure analysis on samples operated for 1–1,000 shots show that extensive damage still exists for at least one contact on all switches observed and that temperatures approaching 500°C are can be reached. However, the n-type AuGe cathode is often found to have no damage observable by scanning electron microscopy (SEM). The observed patterns of contact degradation indicate directions for future contact improvements in lateral switches.

33445 (SAND–93-1597C) **Six degree of freedom fine motion positioning stage based on magnetic levitation.** Arling, R.W. (Arling (R.W.), Windham, NH (United States)); Kohler, S.M. Sandia National Labs., Albuquerque, NM (United States). [1993]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930840–1: 2. international symposium on magnetic suspension technology, Seattle, WA (United States), 11-13 Aug 1993). Order Number DE93017651. Source: OSTI; NTIS; GPO Dep.

The design of a magnetically suspended six degree of freedom positioning system capable of nanometer positioning is presented. The sample holder is controlled in six degrees of freedom (DOF) over 300 micrometers of travel in X, Y and Z directions. A design and control summary, and test results indicating stability and power dissipation are included in the paper. The system is vacuum compatible, uses commercially available materials, and requires minimal assembly and setup.

33446 (SAND–93-1598C) **Motorola MC68040 high-speed design using Altera EPM5000 Erasable programmable logic devices.** Shen, Hui-Chien; Becker, S.M. Sandia National Labs., Albuquerque, NM (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9309201–1: 1993 Institute of Electriccal and Electronic Engineers (IEEE) international ASIC conference and exhibit, Rochester, NY (United States), 27 Sep 1993). Order Number DE93017635. Source: OSTI; NTIS; GPO Dep.

Many designs use EPLD's (Erasable Programmable Logic Devices) to implement control logic and state machines. If the design is slow, timing through the EPLD is not crucial so designers often treat the device as a black box. In high speed designs, timing through the EPLD is critical. In these cases a thorough understanding of the device architecture is necessary. This paper discusses lessons learned in the implementation of a high-speed design using the Altera EPM5130.

33447 (SAND–93-1773C) **Silicon MCM substrates for integration of III-V photonic devices and CMOS IC's.** Seigal, P.; Carson, R.; Flores, R.; Rose, B. Sandia National Labs., Albuquerque, NM (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9307112–1-Vugraphs: International workshop on optoelectronic packaging science, Santa Barbara, CA (United States), 28 Jul 1993). Order Number DE93017894. Source: OSTI; NTIS; GPO Dep.

The progress made in advanced packaging development at Sandia National Laboratories for integration of III-V photonic devices and CMOS IC's on Silicon MCM substrates for planar aid stacked applications will be reported. Studies to characterize precision alignment techniques using solder attach materials compatible with both silicon IC's and III-V devices will be discussed. Examples of the use of back-side alignment and IR through-wafer inspection will be shown along with the extra processing steps that are used. Under bump metallurgy considerations are also addressed.

33448 (UCRL-CR–103699) **Final report on subcontract B076260.** Keszler, D.A. (Oregon State Univ., Corvallis, OR (United States). Dept. of Chemistry). Lawrence Livermore National Lab., CA (United States); Oregon State Univ., Corvallis, OR (United States). Dept. of Chemistry. [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93019501. Source: OSTI; NTIS; GPO Dep.

Work continued on synthesis of borates $A_6MM'(BO_3)_6$, where A=Sr or Ba, M=lanthanide, Y, Sc, In, or Ca, and M'=heavier lanthanide, Sc, Cr, Mn, Fe, Co, In, Ga, Al, Ru, Rh, Ti, Zr, Hf, or Sn. Their structures are discussed, in particular $Sr_6HoSc(BO_3)_6$. Other new borates and gallates are being studied. In the fluoride program, single crystals were grown of RbY_2ScF_{10}; samples codoped with Cr and Nd ions show only Nd fluorescence when excited by Ar laser. Structures of the (laser) materials $LiCaGaF_6$, $LiSrAlF_6$, and Sr_2ScF_7, and fluorescence of the Cr-doped form of the last fluoride were determined. Finally, work on frequency converters include the following: Optical nonlinearities of new borates were calculated. New borates containing Be are being synthesized: $SrBe_2(BO_3)_2$, $BaCuB_2O_5$. Structures of $Rb_2Na(NO_3)_3$, $RbNO_3$, and other nitrates will be used to determine the nitrate group's hyperpolarizability coefficient. Work on organic frequency converters covered L-arginine derivatives, lactones, etc.

33449 (UCRL-JC–113579) **Multi-terrawatt, 100 fsec laser system using flashlamp-pumped, dye- converted Ti:Sapphire as an amplifier.** White, W.E. (Lawrence Livermore National Lab., CA (United States)); Reitize, D.H.; Price, D.F.; Shepherd, R.L.; Bonlie, J.D.; Hunter, J.R.; Patterson, F.G.; Perressini, D.L. Lawrence Livermore National Lab., CA (United States). 14 Apr 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930586–6: Quantum electronics and laser science conference, Baltimore, MD (United States), 2-7 May 1993). Order Number DE93017190. Source: OSTI; NTIS; GPO Dep.

We report on amplification of 100 fsec laser pulses to 250 mJ using flashlamp-pumped, dye converted Ti:Sapphire. The resulting 5 Hz beam is focused to irradiances in excess of 5×10^{18} W/cm^2.

33450 (UCRL-JC–113651) **Integrated circuits: Resistless processing simplifies production and cuts costs.** Weiner, K. Lawrence Livermore National Lab., CA (United States). 25 Mar 1993. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9303198–4: National Center for Advanced Information Components Manufacturing (NCAICM) workshop, Albuquerque, NM (United States), 30-31 Mar 1993). Order Number DE93018069. Source: OSTI; NTIS; GPO Dep.

Reducing the complexity and cost of producing deep-submicrometer integrated circuits (ICs) will soon be possible using a revolutionary approach being developed at the Lawrence Livermore National Laboratory (LLNL). Resistless Projection Doping (RPD) will eliminate the need for photoresist processing during the impurity doping step. This single innovation will reduce the doping sequence from 13 steps to 1 and eliminate the need for five pieces of capital equipment costing more than $5 million. The overall cost of high-volume wafer fabrication will be reduced by more than 10 percent. In addition, the LLNL RPD machine is compact and modular, minimizing facilities costs when compared to today's industry-standard doping equipment. These physical characteristics of the machine also allow the RPD process to be easily incorporated into single-wafer, "cluster" processing tools. When integrated with existing deposition, etching, and annealing steps and developing lithography techniques, the LLNL doping process completes the technology set required to produce a flexible fabrication facility of the future. At one-fifth the cost of current mega-fabrication facilities, the availability of these compact, low-volume, smart factories will give US manufacturers a substantial competitive advantage in the world-wide marketplace for high-value custom and semi-custom integrated circuits.

33451 (UCRL-JC–113814) **Development of robust multilayer optics for use in high-peak power radiation environments.** MacGowan, B.J. (Lawrence Livermore National Lab., CA (United States)); Mrowka, S.; Barbee, T.W. Jr.; Da Silva, L.B.; Eder, D.C.; Koch, J.A.; Turner, J.A.; Underwood, J.H. Lawrence Livermore National Lab., CA (United States). 27 Jul 1993. 8p. Sponsored by USDOE, Washington, DC (United States).

DOE Contract W-7405-ENG-48. (CONF-930405–33: Spring meeting of the Materials Research Society, San Francisco, CA (United States), 12-16 Apr 1993). Order Number DE93018557. Source: OSTI; NTIS; GPO Dep.

In many applications, x-ray multilayer mirrors are exposed to high peak fluxes of x-rays with subsequent damage to the mirror. Mirror damage is a particularly severe problem with the use of multilayers as cavity optics for short wavelength x-ray lasers. Intense optical and x-ray radiation, from the x-ray laser plasma amplifier, often damage the multilayer mirror on time scales of hundreds of picoseconds. The phenomenon of multilayer mirror damage by pulsed x-ray emission has been studied using short duration (500 psec) bursts of soft x-rays 1 from a laser produced gold plasma. The results of the experiments will be compared with some simple models and the possibility of increasing the damage thresholds of short wavelength multilayer mirrors will be discussed.

33452 (UCRL-JC–114422) **Thermal stresses in the microchannel heatsink cooled by liquid nitrogen.** Riddle, R.A. Lawrence Livermore National Lab., CA (United States). 30 Jun 1993. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930722–15: Annual meeting of the Society of Photo-Optical Instrumentation Engineers (SPIE), San Diego, CA (United States), 11-16 Jul 1993). Order Number DE93018660. Source: OSTI; NTIS; GPO Dep.

Microchannel heatsinks represent a highly efficient and compact method for heat removal in high heat flux components. Excellent thermal performance of a silicon microchannel heatsink has been demonstrated using liquid nitrogen as the coolant. For the heating of a 1 square centimeter area, at a heat dissipation of 500 W, a typical silicon heatsink cooled by liquid nitrogen has a thermal resistance of 0.046 $cm^2°K/W$. The actual heatsink structure in this case is only 0.1 cm high. Silicon, although it has excellent thermal properties at liquid nitrogen temperatures, may fracture with very little plastic deformation due to mechanical and thermal stresses. Because the fracture strength of silicon depends on the presence of small defects, strength of the heatsink structures must be addressed to insure highly reliable heatsink devices. Microchannel heatsink reliability can be affected by thermal stresses that arise due to temperature gradients between the base and fin and along the film length. These stresses are combined with the bonding stresses that arise in attaching components at elevated temperatures to the silicon heatsink and then cooling the structure to the cryogenic operating temperatures. These bonding stresses are potentially large because of the differences in the values of the coefficients of thermal expansion in silicon heatsink material, and the attached component materials. The stress results are shown for a 17:1 aspect ratio heatsink cooled in liquid nitrogen. The temperature gradients are a result of a surface heat flux of 1.3 kW/cm^2, approximating the heat dissipation of an RF power chip. The chip is connected to an aluminum nitride substrate, then the chip and substrate module are attached to the heatsink at a bonding temperature of 600°K, as for a gold tin eutectic bond. The stresses are shown to be within the allowables of the materials involved.

43 PARTICLE ACCELERATORS

Refer also to citation(s) 32419, 33016, 34012, 34018

33453 (ANL/ASD/CP–79827) **Basis for the power supply reliability study of the 1 MW neutron source.** McGhee, D.G.; Fathizadeh, M. Argonne National Lab., IL (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9305177–10: 12. International collaboration of advanced neutron sources meeting (ICANS), Abingdon (United Kingdom), 24-28 May 1993). Order Number DE93017735. Source: OSTI; NTIS; INIS; GPO Dep.

The Intense Pulsed Neutron Source (IPNS) upgrade to 1 MW requires new power supply designs. This paper describes the tools and the methodology needed to assess the reliability of the power supplies. Both the design and operation of the power supplies in the synchrotron will be taken into account. To develop a reliability budget, the experiments to be conducted with this accelerator are reviewed, and data is collected on the number and duration of interruptions possible before an experiment is required to start over. Once the budget is established, several accelerators of this type will be examined. The budget is allocated to the different accelerator systems based on their operating experience. The accelerator data is usually in terms of machine availability and system down time. It takes into account mean time to failure (MTTF), time to diagnose, time to repair or replace the failed components, and time to get the machine back online. These estimated times are used as baselines for the design. Even though we are in the early stage of design, available data can be analyzed to estimate the MTTF for the power supplies.

33454 (BNL–48805) **1982–1992: A decade of research on the vacuum ultraviolet ring at the National Synchrotron Light Source.** Brookhaven National Lab., Upton, NY (United States). Apr 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE93019469. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses highlights of research being conducted at the National Synchrotron Light Source in Physics, Chemistry, Biology, and X-ray lithography.

33455 (INIS-RU–347, pp. 299) **Physical basis of the production and employment of ultracold (UCN) very cold (UCN) neutrons at accelerator beams and at thermonuclear reactors.** Zhetbaev, A.K.; Yushkov, A.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. COLD NEUTRONS/particle production; CYCLOTRONS/cold neutrons; CYCLOTRONS/ultracold neutrons; ULTRACOLD NEUTRONS/particle production; ALPHA BEAMS; ALPHA REACTIONS; CYCLOTRONS; NEUTRON BEAMS; THERMONUCLEAR REACTORS

33456 (KEK-PROC–92-5) **Proceedings of the meeting on engineering and technology in basic research.** Kodama, Hideyo; Shibuya, Yoshikazu; Takenaka, Tateru; Tokumoto, Shuichi (eds.). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1992. 375p. (In Japanese). (CONF-9202187–: Meeting on engineering and technology in basic research, Tsukuba (Japan), 6-7 Feb 1992). Order Number DE93520385. Source: OSTI; NTIS; INIS.

This is the report of the technical research meeting of National Laboratory for High Energy Physics held at the Laboratory in Tsukuba on February 6 and 7, 1992. The gists of 16 papers on manufacturing techniques, 15 papers on low temperature technologies, 19 papers on measurement and control technologies, 16 papers on computer and data processing technologies and 20 papers on apparatus technologies are collected in this report. (K.I.).

33457 (LBL–33377) **Accelerator and fusion research division: 1992 Summary of activities.** Lawrence Berkeley Lab., CA (United States). Dec 1992. 133p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93019100. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains brief discussions on research topics in the following area: Heavy-Ion Fusion Accelerator Research; Magnetic Fusion Energy; Advanced Light Source; Center for Beam Physics; Superconducting Magnets; and Bevalac Operations.

33458 (SSCL-Preprint–331) **Development of hermetic electrical connectors for SSC spool pieces.** Kountanis, B. (Superconducting Super Collider Lab., Dallas, TX (US)); Kalny, L. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930537–91: 5. annual international industrial symposium on the Super Collider and exhibition, San Francisco, CA (United States), 6-8 May 1993). Order Number DE93018013. Source: OSTI; NTIS; INIS; GPO Dep.

The Superconducting Super Collider ring is about 54 miles (87 km circumference) and primarily includes a series of magnets. Spool piece assemblies are interspaced in the ring at predetermined intervals to provide specific functions such as cryogenic interfaces, vacuum interface, magnet power, magnet power dump, quench heater power, and special instrumentation. Electrical connectors serve as interfaces for instrumentation and quench heater circuits. These connectors have to meet stringent requirements.

4301 Design, Development, and Operation

Refer also to citation(s) 34013, 34536, 34613

33459 (ANL–93/18) **7-GeV advanced photon source beamline initiative: Conceptual design report.** Argonne National Lab., IL (United States). May 1993. 117p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93018915. Source: OSTI; NTIS; INIS; GPO Dep.

The DOE is building a new generation 6-7 GeV Synchrotron Radiation Source known as the Advanced Photon Source (APS) at Argonne National Laboratory. This facility, to be completed in FY 1996, can provide 70 x-ray sources of unprecedented brightness to meet the research needs of virtually all scientific disciplines and numerous technologies. The technological research capability of the APS in the areas of energy, communications and health will enable a new partnership between the DOE and US industry. Current funding for the APS will complete the current phase of construction so that scientists can begin their applications in FY 1996. Comprehensive utilization of the unique properties of APS beams will enable cutting-edge research not currently possible. It is now appropriate to plan to construct additional radiation sources and beamline standard components to meet the excess demands of the APS users. In this APS Beamline Initiative, 2.5-m-long insertion-device x-ray sources will be built on four straight sections of the APS storage ring, and an additional four bending-magnet sources will also be put in use. The front ends for these eight x-ray sources will be built to contain and safeguard access to these bright x-ray beams. In addition, funds will be provided to build standard beamline components to meet scientific and technological research demands of the Collaborative Access Teams. The Conceptual Design Report (CDR) for the APS Beamline Initiative describes the scope of all the above technical and conventional construction and provides a detailed cost and schedule for these activities. The document also describes the preconstruction R&D plans for the Beamline Initiative activities and provides the cost estimates for the required R&D.

33460 (ANL/APS/IN/VIB–92/4) **Surface wave attenuation characteristics at the APS site.** Jendrzejczyk, J.A.; Wambsganss, M.W.; Smith, R.K. Argonne National Lab., IL (United States). May 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93019508. Source: OSTI; NTIS; GPO Dep.

During operation of the Advanced Photon Source (APS) Facility, there will be many potential sources of vibration that may be transmitted through the ground to the storage ring basement and experimental hall. These sources include chillers, pumps, blowers and fans. Some may produce amplitudes of sufficient magnitude to adversely affect the stability of the closed orbit of the beam. Where possible, these vibration sources will be monitored as they become operational, to determine their vibrational characteristics, such as amplitude and frequency, and duty cycle. Vibrations travel through the ground as body [compression (P) and shear (S)] waves and Rayleigh (R) waves, which are surface waves. The amplitudes of these waves decrease with distance from their source as a result of both geometric and material damping. Because the storage ring basement is "on grade", the authors are primarily interested in waves on the surface. The R-waves, being surface waves, attenuate with distance more slowly than the body waves; for an R-wave, attenuation is proportional to $1/\sqrt{r}$, whereas for a body wave at the surface, attenuation is proportional to $1/r^2$, where r is the distance from the source. Because R-waves attenuate more slowly, they are of primary interest relative to the isolation of vibration-sensitive facilities such as the APS. Measurement of surface wave attenuation requires a vibration source that is capable of producing a ground displacement level considerably greater than that of the ambient background. A pile driver that was used to drive steel pilings at the APS vehicle tunnel provided such a source. This study provides a measure of the attenuation of surface waves in the ground by the combination of geometric and material damping. An average coefficient of attenuation of 0.003 was derived from measured responses to vibrations provided by a pile driver.

33461 (ANL/EP/CP–78374) **Design considerations for high-current superconducting Ion linacs.** Delayen, J.R.; Bohn, C.L.; Micklich, B.J.; Roche, C.T.; Sagalovsky, L. Argonne National Lab., IL (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–330: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018578. Source: OSTI; NTIS; INIS; GPO Dep.

Superconducting linacs may be a viable option for high-current applications such as fusion materials irradiation testing, spallation neutron source, transmutation of radioactive waste, tritium production, and energy production. These linacs must run reliably for many years and allow easy routine maintenance. Superconducting cavities operate efficiently with high cw gradients, properties which help to reduce operating and capital costs, respectively. However, cost-effectiveness is not the sole consideration in these applications. For example, beam impingement must be essentially eliminated to prevent unsafe radioactivation of the accelerating structures, and thus large apertures are needed through which to pass the beam. Because of their high efficiency, superconducting cavities can be designed with very large bore apertures, thereby reducing the effect of beam impingement. Key aspects of high-current cw superconducting linac designs are explored in this context.

33462 (ANL-HEP-CP–93-42) **The Argonne Wakefield Accelerator: Overview and status.** Schoessow, P.; Chojnacki, E.; Gai, W.; Ho, C.; Konecny, R.; Power, J.; Rosing, M.; Simpson, J. Argonne National Lab., IL (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–321: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018584. Source: OSTI; NTIS; INIS; GPO Dep.

The Argonne Wakefield Accelerator (AWA) is a new facility for advanced accelerator research, with a particular emphasis on studies of high gradient (~100 MeV/m) wakefield acceleration. A novel high current short pulse L-Band photocathode and preaccelerator will provide 100 nC electron bunches at 20 MeV to be used as a drive beam, while a second high brightness gun will be used to generate a 5 MeV witness beam for wakefield measurements. We will present an overview of the various AWA systems, the status of construction, and initial commissioning results.

33463 (ANL-HEP-CP–93-43) **Drive linac for the Argonne Wakefield Accelerator.** Chojnacki, E.; Konecny, R.; Rosing, M.; Simpson, J. Argonne National Lab., IL (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–347: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018621. Source: OSTI; NTIS; INIS; GPO Dep.

The drive linac in Phase I of the Argonne Wakefield Accelerator (AWA) will be used to accelerate short duration (10 ps), high charge (100 nC) electron bunches from 2 MV to 20 MV for use in a variety of wakefield acceleration and measurement studies. The high charge is required since this drive bunch will generate the wakefields of interest in various test sections and their amplitudes are proportional to bunch charge. The short bunch duration is required to drive high-frequency wakefields without intra-bunch cancellation effects. The drive linac design was a balance between having a small wake function to maintain a drive bunch energy spread of $\leq$10% and obtaining an adequate accelerating gradient of $\geq$10 MV/m. This yielded a large aperture, low shunt impedance, high group velocity, L-band, standing-wave linac. Details of the design, fabrication, and testing are presented in the following.

33464 (BNL–48259) **RHIC survey and alignment.** Karl, F.X.; Anderson, R.R.; Goldman, M.A.; Hemmer, F.M.; Kazmark, D. Jr.;

Mroczkowski, T.T.; Roecklien, J.C. Brookhaven National Lab., Upton, NY (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-930511–303: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017610. Source: OSTI; NTIS; INIS; GPO Dep.

The Relativistic Heavy Ion Collider consists of two interlaced plane rings, a pair of mirror-symmetric beam injection arcs, a spatially curved beam transfer line from the Alternating Gradient Synchrotron, and a collection of precisely positioned and aligned magnets, on appropriately positioned support stands, threaded on those arcs. RHIC geometry is defined by six beam crossing points exactly in a plane, lying precising at the vertices of a regular hexagon of specified size position and orientation of this hexagon are defined geodetically. Survey control and alignment procedures, currently in use to construct RHIC, are described.

33465 (BNL–49213) **An Inverse Free-Electron-Laser accelerator.** Fisher, A.S. (Brookhaven National Lab., Upton, NY (United States)); Gallardo, J.C.; van Steenbergen, A.; Ulc, S.; Woodle, M.; Sandweiss, J.; Fang, Jyan-Min. Brookhaven National Lab., Upton, NY (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-930511–319: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018674. Source: OSTI; NTIS; INIS; GPO Dep.

Recent work at BNL on electron acceleration using the Inverse Free-Electron Laser (IFEL) has considered a low-energy, high-gradient, multi-stage linear accelerator. Experiments are planned at BNL's Accelerator Test Facility using its 50-MeV linac and 100-GW CO_2 laser. We have built and tested a fast-excitation wiggler magnet with constant field, tapered period, and overall length of 47 cm. Vanadium-Permendur ferromagnetic laminations are stacked in alternation with copper, eddy-current-induced, field reflectors to achieve a 1.4-T peak field with a 4-mm gap and a typical period of 3 cm. The laser beam will pass through the wiggler in a low-loss, dielectric-coated stainless-steel, rectangular waveguide. The attenuation and transverse mode has been measured in waveguide sections of various lengths, with and without the dielectric. Results of 1-D and 3-D IFEL simulations, including wiggler errors, will be presented for several cases: the initial, single-module experiment with ΔE = 39 MeV, a four-module design giving ΔE = 100 MeV in a total length of 2 m, and an eight-module IFEL with ΔE = 210 MeV.

33466 (BNL–52321, pp. 11-22) **Monolithic circuit development for RHIC at Oak Ridge National Laboratory.** Alley, G.T. (Oak Ridge National Laboratory, TN (US)); Britton, C.L. Jr.; Kennedy, E.J.; Newport, D.F.; Wintenberg, A.L.; Young, G.R. Brookhaven National Lab., Upton, NY (United States). [1991]. (CONF-9110232–: Symposium on Relativistic Heavy Ion Collider (RHIC) detector R&D, Upton, NY (United States), 10-11 Oct 1991). In *Proceedings of the symposium on RHIC detector R&D.* 246p. Order Number DE93010855. Source: OSTI; NTIS; INIS.

The work performed for RHIC at Oak Ridge National Laboratory during FY 91 is presented in this paper. The work includes preamplifier, analog memory, and analog-digital converter development for Dimuon Pad Readout, and evaluation and development of preamplifier-shapers for silicon strip readout. The approaches for implementation are considered as well as measured data for the various circuits that have been developed.

33467 (BNL–52321, pp. 23-30) **Highly integrated electronics for the star TPC.** Arthur, A.A. (Lawrence Berkeley Laboratory, CA (US)); Bieser, F.; Hearn, W.; Kleinfelder, S.; Merrick, T.; Millaud, J.; Noggle, T.; Rai, G.; Ritter, H.G.; Wieman, H. Brookhaven National Lab., Upton, NY (United States). [1991]. (CONF-9110232–: Symposium on Relativistic Heavy Ion Collider (RHIC) detector R&D, Upton, NY (United States), 10-11 Oct 1991). In *Proceedings of the symposium on RHIC detector R&D.* 246p. Order Number DE93010855. Source: OSTI; NTIS; INIS.

The concept for the STAR TPC front-end electronics is presented and the progress toward the development of a fully integrated solution is described. It is the goal of the R+D program to develop the complete electronics chain for the STAR central TPC detector at RHIC. It is obvious that solutions chosen e.g. for ALEPH are not adequate for the 150000 channels that need to be instrumented for readout. It will be necessary to perform all the signal processing, digitization and multiplexing directly on the detector in order to reduce per channel cost and the amount of cabling necessary to read out the information. We follow the approach chosen by the EOS TPC project, where the readout electronics on the detector consists of an integrated preamplifier, a hybrid shaping amplifier, an integrated switched capacitor array and a highly multiplexed ADC. The STAR electronics will be further integrated so that approximately 16 channels of the preamplifier, the shaper, the analog store and the ADC will be contained in two integrated circuits located directly on the pad plane.

33468 (BNL–52321, pp. 31-53) **Monolithic readout circuits for RHIC.** O'Connor, P. (Brookhaven National Laboratory, Upton, NY (US)); Harder, J. Brookhaven National Lab., Upton, NY (United States). [1991]. (CONF-9110232–: Symposium on Relativistic Heavy Ion Collider (RHIC) detector R&D, Upton, NY (United States), 10-11 Oct 1991). In *Proceedings of the symposium on RHIC detector R&D.* 246p. Order Number DE93010855. Source: OSTI; NTIS; INIS.

Several CMOS ASICs have been developed for a proposed RHIC experiment. This paper discusses why ASIC implementation was chosen for certain functions, circuit specifications and the design techniques used to meet them, and results of simulations and early prototypes. By working closely together from an early stage in the planning process, in-house ASIC designers and detector and data acquisition experimenters can achieve optimal use of this important technology.

33469 (BNL–52321, pp. 55-61) **New methods for trigger electronics development.** Cleland, W.E. (Univ. of Pittsburgh, PA (US)); Stern, E.G. Brookhaven National Lab., Upton, NY (United States). [1991]. (CONF-9110232–: Symposium on Relativistic Heavy Ion Collider (RHIC) detector R&D, Upton, NY (United States), 10-11 Oct 1991). In *Proceedings of the symposium on RHIC detector R&D.* 246p. Order Number DE93010855. Source: OSTI; NTIS; INIS.

The large and complex nature of RHIC experiments and the tight time schedule for their construction requires that new techniques for designing the electronics should be employed. This is particularly true of the trigger and data acquisition electronics which has to be ready for turn-on of the experiment. We describe the use of the Workview package from VIEWlogic Inc. for design, simulation, and verification of a flash ADC readout system. We also show how field-programmable gate arrays such as the Xilinx 4000 might be employed to construct or prototype circuits with a large number of gates while preserving flexibility.

33470 (DOE/EH–0319) **Environmental Management Assessment of the Continuous Electron Beam Accelerator Facility (CEBAF).** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Office of Environmental Audit. Mar 1993. 174p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93017933. Source: OSTI; NTIS; INIS; GPO Dep.

This report documents the results of the Environmental Management Assessment performed at the Continuous Electron Beam Accelerator Facility (CEBAF) in Newport News, Virginia. During this assessment, activities and records were reviewed and interviews were conducted with personnel from the CEBAF Site Office; the CEBAF management and operating contractor (M&O), Southeastern Universities Research Association, Inc. (SURA); the Oak Ridge Field Office (OR); and the responsible DOE Headquarters Program Office, the Office of Energy Research (ER). The onsite portion of the assessment was conducted from March 8 through March 19, 1993, by the US Department of Energy's (DOE's) Office of Environmental Audit (EH-24) located within the office of Environment, Safety and Health (EH). DOE 5482.1 B, "Environment, Safety and Health Appraisal Program," and Secretary of Energy Notice (SEN)-6E-92, "Departmental Organizational and Management Arrangements," establish the mission of EH-24 to provide comprehensive, independent oversight of Department-wide environmental programs on behalf of the Secretary of Energy. The ultimate goal of EH-24 is enhancement of environmental protection and minimization of risk to public health and the environment. EH-24

accomplishes its mission utilizing systematic and periodic evaluations of the Department's environmental programs within line organizations, and through use of supplemental activities which serve to strengthen self-assessment and oversight functions within program, field, and contractor organizations.

33471 (DOE/ER/40759–1) **Theoretical problems in accelerator physics: Progress report.** Kroll, N.M. California Univ., San Diego, La Jolla, CA (United States). Dept. of Physics. [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-93ER40759. Order Number DE93018954. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the following topics in accelerator physics: radio frequency pulse compression and power transport; computational methods for the computer analysis of microwave components; persistent wakefields associated with waveguide damping of higher order modes; and photonic band gap cavities.

33472 (DOE/FTR–93014873) **Travel to Germany to attend conference on high energy accelerators: Foreign trip report, July 18–26, 1992.** Ostiguy, J.F. Fermi National Accelerator Lab., Batavia, IL (United States). 5 Sep 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. Order Number DE93014873. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This travel report discusses talks conducted at the international conference on high energy accelerator on improving accelerator performance.

33473 (DOE/FTR–93016772) **Travel to Italy to visit the DAΦNE collider advisory committee: Foreign trip report, January 16, 1993–January 23, 1993.** Hutton, A. Southeastern Universities Research Association, Inc., Newport News, VA (United States). 14 Jul 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84ER40150. Order Number DE93016772. Source: OSTI; NTIS (US Sales Only); GPO Dep.

I visited Frascati as the Chairman of the DAΦNE Machine Advisory Committee. (DAΦNE is high current electron-positron collider presently under construction at Frascati.) Presentations were made to the Committee for one and a half days. The members of Committee then met in closed session to start writing a report. Each member of the Committee was assigned some topic or topics to evaluate and the writing usually involved more extensive discussions between the writer and the relevant Group. This procedure is now standard and means that there is a close interaction between the members of the Committee and the Project Team. As Chairman, it was then my task to collate the report and to make a presentation of the Committee's findings to the entire Project staff, and privately to the Project Leader, Gaetano Vignola, and separately to the Laboratory Director. On my first day, I spent two hours with the Director of the Laboratory, Prof. Enzo Iarocci, discussing the collaboration between CEBAF and Frascati on superconducting cavities. Specifically, CEBAF will be sending Mark Augustine for one month in May/June, 1993 to join in the commissioning of LISA (the superconducting linac which is under construction at Frascati). In addition, Frascati is one of several laboratories in Italy which are interested in future collaboration on TESLA, a project in which CEBAF is also interested. Prof. Iarocci would be interested in strengthening the direct ties between the Italian groups and CEBAF. On the last day, I toured LISA and discussed with Franco Tazzioli and Michele Castellano about the program of work that was anticipated over the next few months.

33474 (DOE/FTR–93017248) **Travel to Germany to attend conference on particle accelerators: Foreign trip report, March 20–April 3, 1992.** Chester, N.; Martin, P. Fermi National Accelerator Lab., Batavia, IL (United States). 17 Apr 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. Order Number DE93017248. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The report emphasizes the discussions which N. Chester and P. Martin had with vendors and DESY personnel. Other Fermilab personnel (P. Colestock, C. Moore, K. Koepke) will report on the conference program.

33475 (FNAL/C–93/111) **The Fermilab 400-MeV Linac Upgrade.** Schmidt, C.W. Fermi National Accelerator Lab., Batavia, IL (United States). May 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-930511–245: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017261. Source: OSTI; NTIS; INIS; GPO Dep.

The Fermilab Linac Upgrade will increase the linac energy from 201 MeV to 401.5 MeV. Seven accelerating modules, composed of 805-MHz side-coupled cells, will accelerate H^- beams from 116.5 to 401.5 MeV. The side-coupled structure (SCS) has been built, tuned, tested to full power, and placed in the linac enclosure along side the operating Linac. All seven accelerating modules, each containing four sections of sixteen cells, have been connected to 12-MW power klystrons and tested to full power for a significant period. The transition section to match the beam from the 201.25-MHz drift-tube linac to the SCS, consisting of a sixteen-cell cavity and a vernier four-cell cavity, has also been tested at full power. A new import line from the Linac to the Booster synchrotron with a new Booster injection girder is to be installed. Removal of the last four Alvarez linac tanks (116.5 to 201 MeV) and beam-line installation of the Upgrade components is to begin in early June 1993 and should take about 12 weeks. Beam commissioning of the project will follow and normal operation is expected in a short period. In preparation for beam commissioning, studies are being done with done operating linac to characterize the beam at transition and prepare for phase, amplitude and energy measurements to commission the new linac. The past, present and future activities of the 400-MeV Upgrade will be reviewed.

33476 (FNAL/C–93/156) **Overview of accelerators in medicine.** Lennox, A.J. (Fermi National Accelerator Lab., Batavia, IL (US)). Fermi National Accelerator Lab., Batavia, IL (United States). Jun 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-930511–309: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017811. Source: OSTI; NTIS; INIS; GPO Dep.

Accelerators used for medicine include synchrotrons, cyclotrons, betatrons, microtrons, and electron, proton, and light ion linacs. Some accelerators which were formerly found only at physics laboratories are now being considered for use in hospital-based treatment and diagnostic facilities. This paper presents typical operating parameters for medical accelerators and gives specific examples of clinical applications for each type of accelerator, with emphasis on recent developments in the field.

33477 (INIS-RU–347, pp. 386) **Electrostatic charge-exchange accelerator for investigations on the nuclear spectroscopy and structure.** Aushev, V.E.; Vishnevskij, I.N.; Zaika, N.I.; Totskij, Yu.I. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. TANDEM ELECTROSTATIC ACCELERATORS/nuclear structure; ION BEAMS; POLARIZED BEAMS

33478 (KEK–92-16) **JLC-I.** National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Dec 1992. 249p. Order Number DE93520380. Source: OSTI; NTIS; INIS.

The JLC project is the post-Tristan high energy physics program recommended by the High Energy Committee in 1986. The project consists of the construction of a linear collider and the experiment by using it, at an initial center of mass energy around 500 GeV, and eventually it will reach 1.5 TeV along with the successive upgrading of the machine. According to the recommendation, the systematic research and development program was begun, and many remarkable results have been produced. The recent precision measurement at LEP has greatly enhanced the importance of an e^+e^- linear collider to explore the energy region just above

LEP. The construction of the JLC-I is proposed. The main purpose of the JLC-I is to discover and study the Higgs boson and the top quark which are the two missing constituents of the Standard Model. The physics related to them is described. The technical feasibility of the construction of the JLC-I accelerator is considered. The klystrons that can emit the peak power of about 100 MW and experimentally verify the high acceleration gradient of 100 Mv/m are the target of the research and development. The physics, detectors, the accelerator, the time schedule, the cost estimation and others are described. (K.I.).

33479 (KEK-PROC–92-13) **Proceedings of the third workshop on Japan linear collider (JLC).** Miyamoto, A. (ed.). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Dec 1992. 421p. (CONF-9202186–: 3. workshop on Japan Linear Collider (JLC), Tsukuba (Japan), 18-20 Feb 1992). Order Number DE93520384. Source: OSTI; NTIS; INIS.

The third workshop on the JLC was held at National Laboratory for High Energy Physics in Tsukuba from February 18 to 20, 1992. The research and development works for the accelerator fall into three categories: the optimization of the parameters, the separate research and development works of mostly experimental, and the promotion of the accelerator test facility (ATF) project, placing emphasis on the design and construction of a test damping ring. Regarding the physics, an unambiguous test of nondecoupling top quark effects in electroweak radiative correction was carried out, and some results of the actual analysis of the latest experimental data by it are shown. The physics near the t-anti t threshold at future e^+e^- colliders was reviewed. As for detectors, vertex detector, drift chamber, calorimeter, large solenoid magnet and so on were discussed. The proposal of the JLC-300 is explained, as the recent progress in the experiment and theory points strong toward light top and Higgs below 200 GeV. (K.I.).

33480 (LA-UR–93-2627) **Operation of the high-brightness linac for the advanced free-electron laser initiative at Los Alamos.** Sheffield, R.L.; Austin, R.H.; Chan, K.C.D.; Gierman, S.M.; Kinross-Wright, J.M.; Kong, S.H.; Nguyen, D.C.; Russell, S.J.; Timmer, C.A. Los Alamos National Lab., NM (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930722–19: Annual meeting of the Society of Photo-Optical Instrumentation Engineers (SPIE), San Diego, CA (United States), 11-16 Jul 1993). Order Number DE93018476. Source: OSTI; NTIS; INIS; GPO Dep.

Free-electron lasers and high-energy physics accelerators have increased the demand for very high-brightness beam sources. This paper describes the design of an accelerator which has produced beams of 2.1 π mm-mrad at 1 nC and emittances of 3.7 and 6.5 π mm-mrad for 2 and 3 nC, respectively. The accelerator has been operated between 10 and 18 MeV. The beam emittance growth in the accelerator is minimized by using a photoinjector electron source integrated into the design of the linac, a focusing solenoid to correct the emittance growth caused by space charge, and a special design of the coupling slots between accelerator cavities to minimize quadrupole effects. The FEL has recently operated at 5 microns.

33481 (LBL–33223) **Dynamic accelerator modeling.** Nishimura, Hiroshi. Lawrence Berkeley Lab., CA (United States). May 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-930511–332: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018704. Source: OSTI; NTIS; INIS; GPO Dep.

Object-Oriented Programming has been used extensively to model the LBL Advanced Light Source 1.5 GeV electron storage ring. This paper is on the present status of the class library construction with emphasis on a dynamic modeling.

33482 (LBL–33240) **Commissioning and performance of the Advanced Light Source.** Jackson, A. Lawrence Berkeley Lab., CA (United States). May 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-930511–354: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018712. Source: OSTI; NTIS; INIS; GPO Dep.

The Advanced Light Source (ALS) at the Lawrence Berkeley Laboratory is the first of the lower energy (1- to 2-GeV) third-generation synchrotron radiation facilities to come into operation. Designed with very small electron beam emittances, to operate with long insertion devices to produce very high brightness beams of synchrotron radiation in the VUV and soft x-ray regions of the spectrum, these facilities are complementary to the higher energy (6- to 9-GeV) facilities designed for harder x-radiation. From the earliest periods of their design it was recognized that the performance of the required low-emittance lattices would be dominated by nonlinear particle dynamics caused by the strong lattice sextupoles required for chromatic correction, the effects of undulators and wigglers, and the requirement for very narrow gap vacuum vessels. Commissioning of the ALS storage ring began early in 1993. In this paper we will briefly review the main characteristics of the storage ring design, describe our commissioning experiences, and review the present performance and performance limitations of the facility.

33483 (LBL–34239) **Future prospects for radioactive nuclear beams in North America.** Nitschke, J.M. Lawrence Berkeley Lab., CA (United States). May 1993. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9305203–2: International school seminar on heavy ion physics, Dubna (Russian Federation), 10-15 May 1993). Order Number DE93018526. Source: OSTI; NTIS; INIS; GPO Dep.

In 1989 this author proposed the construction of a dedicated, flexible, radioactive nuclear beams facility that would provide intense beams of nearly all elements for a program of scientific studies in nuclear structure, nuclear reaction dynamics, astrophysics, high-spin physics, nuclei far from stability, material- and surface science, and atomic- and hyperfine-interaction physics. The initial name proposed for the new facility was "IsoSpin Factory" to underscore the key feature of this new physics tool; it was later changed to "IsoSpin Laboratory" (ISL). The ISL is now supported by a broad base of nuclear scientists and has been identified in the US Long Range Plan on Nuclear Science as one of the new potential construction projects for the second part of this decade. Since 1989 a number of conferences and workshops has been held in which the scientific and technical case for RNB facilities has been made. The purpose of this paper is to focus on the North American plan for the ISL, which was initially summarized in a "White Paper" but has since evolved in its scientific and technical scop.

33484 (SAND–93-1486C) **Radiological consequences of radioactivity release from spallation targets.** Miller, L.A.; Williams, D.C. Sandia National Labs., Albuquerque, NM (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-931160–9: American Nuclear Society (ANS) winter meeting, San Francisco, CA (United States), 14-19 Nov 1993). Order Number DE93017627. Source: OSTI; NTIS; INIS; GPO Dep.

A preconceptual design for an Accelerator Production of Tritium (APT) facility is currently under development by several national laboratories in conjunction with industry. The design consists of an accelerator that bombards a spallation target with high energy protons. Neutrons are produced in the spallation target and are absorbed in a blanket material to produce tritium. Two spallation targets are currently under investigation: (1) a tungsten neutron source target and (2) a lead neutron source target. In the tungsten target the neutrons are captured in helium-3, which is circulated through the system, thus producing tritium. The lead target is surrounded with a lithium-aluminum blanket and the tritium is produced in the lithium-6. The investigation of possible radiological impacts on the public is being performed as a part of the safety evaluations of the preconceptual design. These studies include the estimation of releases of radioactive materials from the two spallation targets and the possible impacts on the public.

33485 (SLAC-TN–93-3) **The personnel protection system for a Synchrotron Radiation Accelerator Facility: Radiation safety perspective.** Liu, J.C. Stanford Linear Accelerator Center, Menlo Park, CA (United States). May 1993. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00515. Order Number DE93017931. Source: OSTI; NTIS; INIS; GPO Dep.

The Personnel Protection System (PPS) at the Stanford Synchrotron Radiation Laboratory is summarized and reviewed from the radiation safety point of view. The PPS, which is designed to protect people from radiation exposure to beam operation, consists of the Access Control System (ACS) and the Beam Containment System (BCS), The ACS prevents people from being exposed to the very high radiation level inside the shielding housing (also called a PPS area). The ACS for a PPS area consists of the shielding housing and a standard entry module at every entrance. The BCS prevents people from being exposed to the radiation outside a PPS area due to normal and abnormal beam losses. The BCS consists of the shielding (shielding housing and metal shielding in local areas), beam stoppers, active current limiting devices, and an active radiation monitor system. The system elements for the ACS and BCS and the associated interlock network are described. The policies and practices in setting up the PPS are compared with some requirements in the US Department of Energy draft Order of Safety of Accelerator Facilities.

33486 (SSCL–624) **Measurements of ground motion and SSC dipole vibrations.** Parkhomchuk, V.V. (Budker Institute of Nuclear Physics, Novosibirsk, Russia (Russian Federation)); Shiltsev, V.D.; Weaver, H.J. Superconducting Super Collider Lab., Dallas, TX (United States). Jun 1993. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE93018651. Source: OSTI; NTIS; INIS; GPO Dep.

The results of seismic ground measurements at the Superconducting Super Collider (SSC) site and investigations of vibrational properties of superconducting dipoles for the SSC are presented. Spectral analysis of the data obtained in the large frequency band from 0.05 Hz to 2000 Hz is done. Resonant behavior and the dipole-to-ground transform ratio are investigated. The influence of measured vibrations on SSC operations is considered.

33487 (SSCL-Preprint–310) **Industry participation in the SSCL installation program.** Spinos, F. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930537–87: 5. annual international industrial symposium on the Super Collider and exhibition, San Francisco, CA (United States), 6-8 May 1993). Order Number DE93016893. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. SUPERCONDUCTING SUPER COLLIDER/cooperation; COOPERATION; INDUSTRY

33488 (UCRL-JC–112076) **Burst mode FEL with the ETA-III induction linac.** Lasnier, C.J. (and others); Allen, S.L.; Felker, B. Lawrence Livermore National Lab., CA (United States). 13 May 1993. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930511–315: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018102. Source: OSTI; NTIS; INIS; GPO Dep.

Pulses of 140 GHz microwaves have been produced at a 2 kHz rate using the ETA-III induction linac and IMP wiggler. The accelerator was run in bursts of up to 50 pulses at 6 MeV and greater than 2 kA peak current. A feedback timing control system was used to synchronize acceleration voltage pulses with the electron beam, resulting in sufficient reduction of the corkscrew and energy sweep for efficient FEL operation. Peak microwave power for short bursts was in the range 0.5–1.1 GW, which is comparable to the single-pulse peak power of 0.75–2 GW. FEL bursts of more than 25 pulses were obtained.

33489 (UCRL-JC–114214) **Design study of a microwave driver for a Relativistic Klystron Two-Beam Accelerator.** Houck, T.L. Lawrence Livermore National Lab., CA (United States). May 1993. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930511–360: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018665. Source: OSTI; NTIS; INIS; GPO Dep.

In two-beam accelerators, the reacceleration of a modulated drive beam can enable high conversion efficiency of electron beam energy to rf energy. However, the stability issues involved with the transport of high current electron beams through rf extraction structures and induction accelerator cells are critical. The author reports on theoretical studies and computer simulations of a two-beam accelerator design using traveling-wave extraction structures. Specific issues addressed include regenerative and cumulative transverse instabilities.

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Refer also to citation(s) 33525, 33526, 33530, 33559, 33587, 33605, 33632, 33637, 33638, 33639, 33644, 34615, 34622

33490 (ANL/ASD/CP–78300) **Global coupling and decoupling of the APS storage ring.** Chae, Y.C.; Liu, J.; Teng, L.C. Argonne National Lab., IL (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–314: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017704. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes a study of controlling the coupling between the horizontal and the vertical betatron oscillations in the 7-GeV Advanced Photon Source (APS) storage ring. First, we investigate the strengthening of coupling using two families of skew quadrupoles. Twenty skew quadrupoles are arranged in the 40 sectors of the storage ring and powered in such a way so as to generate both quadrature components of the required 21st harmonic. The numerical results from tracking a single particle are presented for the various configurations of skew quadrupoles. Second, we describe the global decoupling procedure to minimize the unwanted coupling effects. These are mainly due to the random roll errors of normal quadruples. It is shown that even with the rather large rms roll error of 2 mrad, the coupling effects can be compensated for with 20 skew quadrupoles each having maximum strength one order of magnitude lower than the typical normal quadrupole strength.

33491 (ANL/ASD/CP–78331) **Closed orbit correction using singular value decomposition of the response matrix.** Chung, Y.; Decker, G.; Evans, K. Jr. Argonne National Lab., IL (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–317: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017967. Source: OSTI; NTIS; INIS; GPO Dep.

A theory of global orbit correction using the technique of singular value decomposition (SVD) of the response matrix and simulation of its application to the Advanced Photon Source (APS) storage ring are presented. The response matrix relates beam motion at the beam position monitor (BPM) locations to changes in corrector magnet strengths. SVD reconfigures the BPMs and correctors into the same number of "transformed" BPMs (t-BPMs) and "transformed" correctors (t-correctors), each T-BPM being coupled to at most one t-corrector and vice versa with associated coupling strength which determines the efficiency of orbit correction. The coefficients of these linear transformations can be used to determine which BPMs and correctors are the most effective. Decoupling the weakly coupled pairs will enhance the overall correction efficiency at the expense of accuracy. The orbit errors at decoupled t-BPMs are conserved and the strengths of decoupled t-correctors can be adjusted appropriately to optimize the actual corrector strengths. This method allows for estimating the limitation on orbit correction with given sets of BPMs and correctors, as well as optimizing the connector strengths without overloading the corrector magnet power supplies.

33492 (ANL/ASD/CP–78334) **Global DC closed orbit correction experiments on the NSLS X-ray ring and SPEAR.** Chung, Y. (Argonne National Lab., IL (United States)); Decker, G.; Evans, K. Jr.; Safranek, J.; So, I.; Tang, Y.; Corbett, W.J.; Hettel, R. Argonne National Lab., IL (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–310: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017697. Source: OSTI; NTIS; INIS; GPO Dep.

The global closed orbit correction experiments conducted on the NSLS X-my ring and the SPEAR using the technique of singular value decomposition (SVD) are presented. The beam response matrix, defined as beam motion at beam position monitor (BPM) locations per unit kick by correctors magnets, was measured and then analyzed using SVD. The BPMs and correctors are reconfigured into "transformed" BPMs (t-BPMs) and "transformed" correctors (t-correctors), with each t-BPM coupled to at most one t-corrector and vice versa for orbit correction. The decoupled t-BPMs are used to estimate the limit on orbit correction, while the decoupled t-correctors are used to optimize the corrector strengths. As a result, the vertical r.m.s. orbit error at the BPM locations was reduced from 208 μm to 61 μm about an arbitrary reference orbit in the NSLS X-ray ring. In SPEAR, the vertical closed, orbit was brought to the BPM centers at the selected BPM locations with an r.m.s. error of 215 μm reduced from the initial 780 μm.

33493 (ANL/EP/CP–78372) **Alternating-phase focusing with amplitude modulation.** Sagalovsky, L.; Delayen, J.R. Argonne National Lab., IL (United States). [1993]. 3p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–367: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018618. Source: OSTI; NTIS; INIS; GPO Dep.

We have previously developed a model of alternating-phase focusing (APF) applicable to ion linacs comprised of short independently controlled cavities. The main beam dynamical aspects of APF are adequately described by four parameters: Equilibrium synchronous phase, phase modulation amplitude, length of APF period, and incremental energy gain. In this paper we report on an extension of the analysis to include simultaneous modulation of the accelerating field amplitude. Two additional parameters are included: Relative phase between the amplitude and phase modulation and magnitude of the amplitude modulation. The effects of amplitude modulation on the stable regions and longitudinal acceptance are discussed.

33494 (ANL/EP/CP–78375) **Halo formation in mismatched, space-charge-dominated beams.** Bohn, C.L.; Delayen, J.R. Argonne National Lab., IL (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–345: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018581. Source: OSTI; NTIS; INIS; GPO Dep.

A semianalytic formalism was recently developed for investigating the transverse dynamics of a mismatched, space-charge-dominated beam propagating through a focusing channel. It uses the Fokker-Planck equation to account for the rapid evolution of the coarse-grained distribution function in the phase space of a single beam particle. A simple model of dynamical friction and diffusion represents the effects of turbulence resulting from charge redistribution. The initial application was to sheet beams. In this paper, the formalism is generalized to fully two-dimensional beams.

33495 (ANL/PHY/CP–78090) **Applications of matrix optics to acceptance studies in low-beta ion linacs.** Joh, K.; Nolen, J.A. Argonne National Lab., IL (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–295: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017538. Source: OSTI; NTIS; INIS; GPO Dep.

Four-gap superconducting resonators have been developed at Argonne for use in the low-beta positive ion injector (PII) for ATLAS. These structures have been used successfully for ion velocities as low as 0.007c with q/m = 0.1. First order matrix optics and linear theory for the phase space transformations in accelerating systems are applied to the PII linac which includes low-beta heavy ion rf resonators and magnetic solenoids. These provide a new method to match initial phase space ellipses when used with higher order transfer maps or ray-tracing calculations. And also we present a quantitative measure of nonlinearities using the concept of rms emittances and deviations of phase space coordinates between linear and nonlinear transformations. As a byproduct a way of identifying the dominant source of nonlinearity of system is indicated.

33496 (BNL–49212) **Symplectic tracking using point magnets and a reference orbit made of circular arcs and straight lines.** Parzen, G. Brookhaven National Lab., Upton, NY (United States). Jun 1993. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (AD/RHIC–120). Order Number DE93019924. Source: OSTI; NTIS; INIS; GPO Dep.

In order to study long term stability, it appears desirable that the particle tracking by symplectic. One way to achieve symplectic tracking is to replace the magnets by a series of point magnets and drift spaces. This approach is modified here by using a reference orbit that is made up of arcs of circles and straight lines which join smoothly with each other. This make sthe symplecticity more evident, and simplifies in some way the particle tracking, as the coordinate system based on this reference orbit is not changing discontinuously between elements. It also allows the use of transfer matrices to find the linear orbit parameters. For this choice of reference orbit, the required ersults are obtained to track particles, which are the transfer functions, the transer matrices and the transfer time, for the different elements present in the accelerator. It is shown that, in the absence of longitudinal magnetic fields these results provide a symplectic, second order itnegrator. Existing tracking programs that use a reference orbit, made up of arcs of circles and straight lines, can be modified, using the results given here to do symplectic tracking with point magnets. The results have been used to modify the ORBIT tracking program. The ORBIT program will now, by changing an indicator, either track using the usual large accelerator approximation for the transfer functions or do symplectic tracking with ponit magnets, and will use the same reference orbit in both cases.

33497 (BNL–49276) **RF phase stabilization for RF photocathode gun through electro-optical monitoring.** Leung, K.P.; Yu, L.H.; Ben-Zvi, I. Brookhaven National Lab., Upton, NY (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-930722–20: Annual meeting of the Society of Photo-Optical Instrumentation Engineers (SPIE), San Diego, CA (United States), 11-16 Jul 1993). Order Number DE93019059. Source: OSTI; NTIS; GPO Dep.

An electro-optical technique is being developed at the Brookhaven National Laboratory (BNL) Accelerator Test Facility (ATF) to monitor and control the phase of the photocathode laser beam with respect to the RF drive field for the RF photocathode gun. This technique utilizes the RF field induced birefringence which is probed by the photocathode laser beam. A proof-of-principle experiment is described which has been performed using the ATF RF photocathode gun injection system for the linac.

33498 (BNL–49436) **Errors in Siberian snakes.** Courant, E.D. Brookhaven National Lab., Upton, NY (United States). Aug 1993. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (AD/RHIC–121). Order Number DE93040383. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication BEAM DYNAMICS/corrections; ERRORS; POLARIZED BEAMS; BETATRON OSCILLATIONS; SPIN; BROOKHAVEN RHIC; CORRECTIONS

33499 (DOE/ER/40150–227) **Laser powered beam conditioner for free-electron lasers and synchrotrons.** Liu, H.; Neil, G.R.; Sinclair, C.; Yunn, B. Southeastern Universities Research Association, Inc., Newport News, VA (United States). Continuous Electron Beam Accelerator Facility. Jun 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84ER40150. (CEBAF-PR–93-030;CONF-930511–316: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017821. Source: OSTI; NTIS; INIS; GPO Dep.

A new method of using an additional laser for electron beam conditioning in free-electron lasers (FELs) and synchrotrons is proposed. Theoretical analysis and calculations are presented, showing that the axial energy spread of electrons due to their betatron motion in undulators can be dramatically reduced by interacting with a quasi-TEM_{10} Gaussian mode optical beam. It is requried that the electrons be prebunched over half an optical cycle in advance.

33500 (DOE/ER/40747–1) **The partial Siberian snake experiment at the Brookhaven AGS.** Huang, H. (Indiana Univ.

Cyclotron Facility, Bloomington, IN (United States)); Caussyn, D.D.; Ellison, T.; Jones, B.; Lee, S.Y.; Schwandt, P.; Ahren, L.; Alessi, J.; Bleser, E.J.; Bunce, G.; Cameron, P.; Courant, E.D.; Foelsche, H.W.; Gardner, C.J.; GellerIndiana Univ., Bloomington, IN (United States). [1992]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-92ER40747. (CONF-920315–48: EPAC 92: 3. European particle accelerator conference: accelerators for special applications, Berlin (Germany), 24-28 Mar 1992). Order Number DE93017205. Source: OSTI; NTIS; INIS; GPO Dep.

We are building a 4.7 Tesla-meter room temperature solenoid to be installed in a 10-foot long AGS straight section. This experiment will test the idea of using a partial snake to correct all depolarizing imperfection resonances and also test the feasibility of betatron tune jump in correction intrinsic resonances in the presence of a partial snake.

33501 (DOE/ER/40747–3) **Studies of polarized beam acceleration and Siberian Snakes.** Lee, S.Y. Indiana Univ., Bloomington, IN (United States). Dept. of Physics. [1992]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-92ER40747. (CONF-921131–13: 10. international symposium on high-energy spin physics, Nagoya (Japan), 9-14 Nov 1992). Order Number DE93017207. Source: OSTI; NTIS; INIS; GPO Dep.

We studied depolarization mechanisms of polarized proton acceleration in high energy accelerators with snakes and found that the perturbed spin tune due to the imperfection resonance plays an important role in beam depolarization at snake resonances. We also found that even order snake resonances exist in the overlapping intrinsic and imperfection resonances. Due to the perturbed spin tune of imperfection resonances, each snake resonance splits into two. Thus the available betatron tune space becomes smaller. Some constraints on polarized beam colliders were also examined.

33502 (DOE/ER/40747–4) **On the polarized beam acceleration in medium energy synchrotrons.** Lee, S.Y. Indiana Univ., Bloomington, IN (United States). Dept. of Physics. [1992]. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-92ER40747. (CONF-9211185–2: RCNP Kikuchi school on spin physics at intermediate energies, Osaka (Japan), 16-19 Nov 1992). Order Number DE93017208. Source: OSTI; NTIS; INIS; GPO Dep.

This lecture note reviews physics of spin motion in a synchrotron, spin depolarization mechanisms of spin resonances, and methods of overcoming the spin resonances during acceleration. Techniques used in accelerating polarized ions in the low/medium energy synchrotrons, such as the ZGS, the AGS, SATURNE, and the KEK PS and PS Booster are discussed. Problems related to polarized proton acceleration with snakes or partial snake are also examined.

33503 (DOE/ER/40747–7) **Even order snake resonances.** Lee, S.Y. Indiana Univ., Bloomington, IN (United States). Dept. of Physics. [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-92ER40747. (CONF-930511–329: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018447. Source: OSTI; NTIS; INIS; GPO Dep.

We found that the perturbed spin tune due to the imperfection resonance plays an important role in beam depolarization at snake resonances. We also found that even order snake resonances exist in the overlapping intrinsic and imperfection resonances. Due to the perturbed spin tune shift of imperfection resonances, each snake resonance splits into two.

33504 (FNAL/C–93/120) **Chromaticity compensation scheme for the Main Injector.** Bogacz, S.A. Fermi National Accelerator Lab., Batavia, IL (United States). May 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-930511–246: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017260. Source: OSTI; NTIS; INIS; GPO Dep.

The current Main Injector lattice is studied in the context of full chromaticity compensation in the presence of the eddy current, saturation and the end-pack sextupole fields generated by the dipole magnets. Two families of correcting sextupole magnets are placed to compensate these fields and to adjust the chromaticity (in both planes) to some desired value. Variation of the dipole induced sextupole fields with the B-field (changing along a ramp) are modeled according to recent experimental measurements of the Main Injector dipole magnet Analysis of the required sextupole strengths is carried out along two realistic momentum ramps. The results of our calculation give quantitative insight into the requisite performance of the sextupole magnets.

33505 (FNAL/C–93/173) **Beta measurements and modeling the Tevatron.** Gelfand, N.M. Fermi National Accelerator Lab., Batavia, IL (United States). Jun 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-930511–310: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017806. Source: OSTI; NTIS; INIS; GPO Dep.

The Tevatron collider is now able with two low-β (β^*=0.25–0.5m) interaction regions denoted as B0 and D0. This lattice allows independent operation of the interaction regions which required that the previous collider lattice, used in 1988–89, had to be modified. In order to see how well the lattice conforms to the design, measurements of the β function have been carried out at 15 locations in the new Tevatron collider lattice. Agreement can be obtained between the measurements and a computer model for the Tevatron, based on the design, only if the strengths of the gradients in the quadrupoles in the low-β triplet are allowed to differ from their design values. It is also observed that the lattice is very sensitive to the precise values of the gradients in these magnets.

33506 (KEK-PROC–92-12) **The proceedings of the KEK FEL simulation code workshop.** Kamitani, Takuya (ed.). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Nov 1992. 217p. (In Japanese). (CONF-9103277–: KEK FEL simulation code workshop, Tsukuba (Japan), 15 Mar 1991). Order Number DE93520378. Source: OSTI; NTIS; INIS.

This is the record of the lectures in free electron laser simulation code workshop held in National Laboratory for High Energy Physics on March 15, 1991. As the device that can generate especially powerful and coherent light in the wide wavelength region from long wavelength like microwave to short wavelength like X-ray and gamma ray, the interest in free electron laser has heightened in Japan and foreign countries, and also the experiments have been carried out actively. Also the necessity of the quantitative theoretical calculation using the simulation has become high, and the researches have been carried out in various places. This workshop was held for the intention of offering the place for the interchange of researches, the exchange of information and discussion. 39 persons took part in the workshop, and 11 lectures were given, and it was very useful. (K.I.).

33507 (LBL–33285) **Coherence and linewidth studies of a 4-nm high power FEL.** Fawley, W.M. (Lawrence Berkeley Lab., CA (United States)); Sessler, A.M.; Scharlemann, E.T. Lawrence Berkeley Lab., CA (United States). May 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (HIFAN–570;CONF-930511–323: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018533. Source: OSTI; NTIS; INIS; GPO Dep.

Recently the SSRL/SLAC and its collaborators elsewhere have considered the merits of a 2 to 4-nm high power FEL utilizing the SLAC linac electron beam. The FEL would be a single pass amplifier excited by spontaneous emission rather than an oscillator, in order to eliminate the need for a soft X-ray resonant cavity. We have used GINGER, a multifrequency 2D FEL simulation code, to study the expected linewidth and coherence properties of the FEL, in both the exponential and saturated gain regimes. We present results concerning the effective shot noise input power and mode shape, the expected subpercent output line widths, photon flux, and the field temporal and spatial correlation functions. We also discuss the effects of tapering the wiggler upon the output power and line width.

33508 (LBL–33286) **Three dimensional multipole decomposition of fields.** Hahn, K. Lawrence Berkeley Lab., CA (United States). May 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098.

(HIFAN–571;CONF-930511–322: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018530. Source: OSTI; NTIS; INIS; GPO Dep.

A new method to generate the general multipole representation of the three dimensional static field, electric or magnetic, is obtained via a scalar potential evaluated from the arbitrary specified source. As an application of this formulation, a previously described 3-D electric field decomposition method has been further generalized to the magnetic field.

33509 (LBL–34072) **Capture from pair production as a beam loss mechanism for heavy ions at RHIC.** Feinberg, B. (Lawrence Berkeley Lab., CA (United States)); Belkacem, A.; Bossingham, R.; Gould, H.; Meyerhof, W.E. Lawrence Berkeley Lab., CA (United States). May 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-930511–351: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018710. Source: OSTI; NTIS; INIS; GPO Dep.

Electron capture from electron-positron pair production is predicted to be a major source of beam loss for the heaviest ions at RHIC. Achieving the highest luminosity thus requires an understanding of the capture process. We report the first observation and measurement of this process, in Bevalac experiments using 1 GeV/u U^{92+} projectiles on Au targets. Capture from pair production is a process in which the very high electromagnetic field involved in the collision of two relativistic heavy ions polarizes the vacuum, resulting in the production of an electron-positron pair and the capture of the electron by one of the ions. There are many theoretical papers published on capture from pair production with very large discrepancies between predicted cross sections. The experimental results are compared to theory, and the implications of extrapolations to RHIC energies are presented.

33510 (SSCL–578-Rev.1) **Longitudinal beam dynamics with rf noise.** Shih, H.J. (Superconducting Super Collider Lab., Dallas, TX (United States)); Ellison, J.A.; Cogburn, R.; Newberger, B.S. Superconducting Super Collider Lab., Dallas, TX (United States). Jun 1993. 41p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE93018649. Source: OSTI; NTIS; INIS; GPO Dep.

The Dome-Krinsky-Wang (DKW) diffusion-inaction theory for rf-noise-induced emittance dilution is reviewed and related to recent work on the approximation of stochastic processes by Markov processes. An accurate and efficient numerical procedure is developed to integrate the diffusion equation of the DKW theory. Tracking simulations are undertaken to check the validity of the theory in the parameter range of the Superconducting Super Collider (SSC) and to provide additional information. The study of effects of rf noise is applied to two problems of interest at the SSC: (1) determination of noise tolerance levels in the rf system, and (2) feasibility of beam extraction using crystal channeling.

33511 (SSCL–626) **Lattice design study for the HEB to collider transfer lines.** Wang, F.; Brown, K.; McGill, J.; Johnson, D. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE93018912. Source: OSTI; NTIS; INIS; GPO Dep.

The High Energy Booster (HEB) ring is the last booster of the 20-TeV Superconducting Super Collider (SSC). The 2-TeV beam transfer lines between these two giant accelerator complexes should meet all geometrical and optical matching conditions while having sufficient tuning flexibility. The lattice design of these lines also has to be concerned with the huge energy each HEB extracted batch carries. A compact lattice design with all magnets being resistive was adopted for its optical flexibility, operational reliability, and cost saving. The design study in this paper is an effort to solve inter-accelerator transfer line optical problems dealing with insufficient phase advance and strict matching requirements.

33512 (SSCL–631) **Minimal interference beam size/profile measurement techniques applicable to the Collider.** Nexsen, W.; Dutt, S.; Kauffmann, S.; Lebedev, V.; Maschke, A.; Mokhov, N.; Richardson, R.; Tsyganov, E.; Zinchenko, A. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE93018913. Source: OSTI; NTIS; INIS; GPO Dep.

The imaging of synchrotron radiation (SR) has been suggested as a technique for providing a continuous, non-interfering monitor of the beam profile in the Collider rings at the Superconducting Super Collider. A closer examination has raised questions concerning the applicability of SR imaging in this case because of the diffraction broadening of the image, the requirements for axial space and location in the lattice, and the complexity of the system. We have surveyed the known, alternative, minimal interference techniques for measuring beam size and have evaluated them for possible Collider usage. We conclude that of the approaches that appear feasible, all require at least some development for our usage and that the development of an electron beam probe offers the best promise. We recommend that flying wires be used for cross-checking and calibrating the electron beam probe diagnostic and for luminosity measurements when the highest accuracy is required, but flying wires should not be used as the primary diagnostic because of their limited lifetime.

33513 (SSCL-Preprint–403) **Beam loading effect in SSCL coupled cavity linac.** Senichev, Yu.; Cutler, R.; Hurd, J.; Raparia, D. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930511–391: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93019119. Source: OSTI; NTIS; INIS; GPO Dep.

The Superconducting Super Collider Accelerating Complex consists of a cascade of accelerators and each one of them accelerates the beam to some energy and then transfers it to the next stage. The design luminosity of $10^{33}cm^{-2}s^{-1}$ is obtained by the high efficiency of all stages and the ability to accelerate beam with as minimum emittance growth as possible. For this purpose the Linac pulse length is specified as 9 ps in order to minimize the number of target crossings and so to minimize the emittance growth during charge exchange injection into the LEB booster. However, the transient caused by switching on the beam makes up a significant part of the pulse length and can influence the characteristics of beam. In this paper we present the results of the transient study of the coupled cavity linac and discuss the model that predicts the parametric resonance between the beam and the field distortion setup during transient.

33514 (SSCL-Preprint–474) **The linkage of Zlib to Teapot for auto-differentiation map extraction and nonlinear analysis.** Sun, N.; Yan, Y.T.; Pilat, F.; Bourianoff, G. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930511–350: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018758. Source: OSTI; NTIS; INIS; GPO Dep.

The differential Lie algebraic numerical library, Zlib has been linked to Teapot, the accelerator simulator code. This makes possible the use of the operational correction features of Teapot to produce a corrected lattice, and then choose either map or thin element-by-element tracking for tracking studies. Thin-element tracking is more accurate but slower than map tracking; therefore, the option of choosing one or the other is very desirable.

33515 (UCRL-JC–111188) **3D simulations of an electrostatic quadrupole injector.** Grote, D.P. (California Univ., Davis, CA (United States)); Friedman, A.; Yu, S. Lawrence Livermore National Lab., CA (United States). Feb 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930269–19: Computational accelerator physics conference (CAP93), Pleasanton, CA (United States), 22-26 Feb 1993). Order Number DE93018635. Source: OSTI; NTIS; GPO Dep.

Analysis of the dynamics of a space charge dominated beam in a lattice of electrostatic focusing structures requires a full three-dimensional conic that includes self-consistent space charge fields and the fields from the complex conductor shapes. The existing WARP3d code, a particle simulation code which has been developed for heavy-ion fusion (HIF) applications contains machinery for

handling particles in three-dimensional fields. A successive overrelaxation field solver with subgrid-scale placement of boundaries for rounded surface and four-fold symmetry has been added to the code. The electrostatic quadrupole (ESQ) injector for the ILSE accelerator facility being planned at Lawrence Berkeley Laboratory is shown as an application. The issue of concern is possible emittance degradation because the focusing voltages are a significant fraction of the particles' energy and because there are significant nonlinear fields arising from the shapes of the quadrupole structures.

33516 (UCRL-JC–112263) **Graphical user interface for AMOS and POISSON.** Swatloski, T.L. Lawrence Livermore National Lab., CA (United States). 2 Mar 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930269–18: Computational accelerator physics conference (CAP93), Pleasanton, CA (United States), 22-26 Feb 1993). Order Number DE93018654. Source: OSTI; NTIS; GPO Dep.

A graphical user interface (GUI) exists for building model geometry for the time-domain field code, AMOS. This GUI has recently been modified to build models and display the results of the Poisson electrostatic solver maintained by the Los Alamos Accelerator Code Group called POISSON. Included in the GUI is a 2-D graphic editor allowing interactive construction of the model geometry. Polygons may be created by entering points with the mouse, with text input, or by reading coordinates from a file. Circular arcs have recently been added. Once polygons are entered, points may be inserted, moved, or deleted. Materials can be assigned to polygons, and are represented by different colors. The unit scale may be adjusted as well as the viewport. A rectangular mesh may be generated for AMOS or a triangular mesh for POISSON. Potentials from POISSON are represented with a contour plot and the designer is able to mouse click anywhere on the model to display the potential value at that location. This was developed under the X windowing system using the Motif look and feel.

33517 (UCRL-JC–112511) **Spice modeling of a FET-switched induction accelerator cell.** Ollis, C.W.; Cravey, W.R.; Hawkins, S.A.; Kirbie, H.C.; Newton, M.A. Lawrence Livermore National Lab., CA (United States). 11 Jun 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930616–19: 9. IEEE pulsed power conference, Albuquerque, NM (United States), 21-23 Jun 1993). Order Number DE93018662. Source: OSTI; NTIS; GPO Dep.

A PSpice model of an induction accelerator cell switched by field-effect transistors (FETS) has been developed to simulate the modulator's circuit performance and induction core flux behavior. A FET switched induction cell has been built that generate 4-kV, 1 μs pulses at pulse rates exceeding 100 kHz. The circuit architecture provides for core reset between pulses and produces bursts of pulses that are variable in amplitude, pulse width and prf. The transistor switching array, energy storage capacitors, reset circuit, and cell core are all combined into a compact, low-impedance package. This high-prf induction cell is being developed as the accelerating element for a proposed heavy-ion recirculator, which is an arrangement of many small induction mM in a 30m diameter circle. The recirculator will accept 10-MeV ions from a linear ion accelerator, under development at the Lawrence Berkeley Laboratory, and continue their acceleration to 60-MeV by repeatedly passing the ion beam through the many 5-kV cells. As the ions gain speed, the cell prf must also keep pace by increasing from 70 kHz to 200 kHz. Simple PSpice models have been used to predict B-H loop behavior in the magnetic core and to analyze circuit performance. Simulations of the induction cell will be presented and compared with experimental data.

33518 (UCRL-JC–113638) **Computer assisted accelerator tuning.** Boyd, J.K. Lawrence Livermore National Lab., CA (United States). 14 Apr 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930511–224: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017195. Source: OSTI; NTIS; GPO Dep.

The challenge of tuning an induction accelerator in real time has been addressed with the new TUNE GUIDE code. The code initializes a beam at a particular position using a tracer particle representation of the phase space. The particles are transported, using a matrix formulation, element by element along the beamline assuming that the field of a solenoid, or steering element is constant over its length. The other allowed elements are gaps and drift sections. A great deal of effort has been spent programming TUNE GUIDE to operate under the IBMPC Windows 3.1 system. This system features an intuitive, menu driven interface, which provides an ability to rapidly change beamline component parameter values. Consequently various accelerator setups can be explored and new values determined in real time while the accelerator is operating. In addition the code has the capability of varying a capability value over a range and then plotting the resulting beam properties, such as radius or centroid position, at a down stream position. Element parameter editing is also included along with an on-line hyper text oriented help package.

4303 Auxiliaries and Components

Refer also to citation(s) 32620, 33504, 33510, 33511, 33512, 33513, 33634, 33642, 33643, 33649, 33652, 33653, 33687, 34058, 34488, 34528, 34612, 34614, 34621

33519 (ANL/ASD/CP–78165) **Thermal analysis of the beam missteering in APS storage ring.** Sheng, I.C.; Howell, J.; Sharma, S. Argonne National Lab., IL (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–357: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018620. Source: OSTI; NTIS; INIS; GPO Dep.

Several bending magnet beam missteering cases have been investigated for the 7-GeV storage ring of the Advanced Photon Source (APS). One of the critical missteering events is presented in this paper. Finite element analyses are performed to solve for both temperature and stress fields. Thermally induced deflections are determined by using beam bending theory. A safe current limit is established for the storage ring chambers.

33520 (ANL/ASD/CP–78166) **A conceptual design and thermal analysis of high heat load crotch absorber.** Sheng, I.C.; Sharma, S.; Rotela, E.; Howell, J. Argonne National Lab., IL (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–361: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017750. Source: OSTI; NTIS; GPO Dep.

A high heat load crotch absorber has been designed for the Advanced Photon Source (APS) storage ring curved chambers. The absorber, which uses a beryllium diffuser brazed to oxygen free high-conductivity copper (OFHC) plates, has been optimized to spread the beam power in order to reduce its temperature rise and thermal stresses. Circular copper tubes are brazed to the absorber for water cooling. The absorber design and analytical results from a three-dimensional finite element model are presented in this paper.

33521 (ANL/ASD/CP–78289) **Noise reduction techniques used on the high power klystron modulators at Argonne National Laboratory.** Russell, T.J. Argonne National Lab., IL (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–291: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017692. Source: OSTI; NTIS; INIS; GPO Dep.

The modulators used in the Advanced Photon Source at Argonne National Laboratory have been redesigned with an emphasis on electrical noise reduction. Since the modulators are 100 MW modulators with <700 ns rise time, electrical noise can be coupled very easily to other electronic equipment in the area. This paper will detail the effort made to reduce noise coupled to surrounding equipment. Shielding and sound grounding techniques accomplished the goal of drastically reducing the noise induced in surrounding equipment. The approach used in grounding and shielding will be discussed, and data will be presented comparing earlier designs to the improved design.

33522 (ANL/ASD/CP–78292) **Update on the Argonne positron accumulator ring.** Borland, M. Argonne National Lab., IL (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–313: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017738. Source: OSTI; NTIS; INIS; GPO Dep.

The injector for the Advanced Photon Source incorporates a 450-MeV positron accumulator ring (PAR) to decrease the filling time with the 2-Hz synchrotron. In addition to accumulating positrons from the linac, the PAR damps the beam and reduces the bunch length. The PAR lattice has been redesigned to use zero-gradient dipoles, while retaining essentially the same damping partition. Extensive simulations have been performed to set tolerances that will give high capture efficiency, in spite of the large momentum spread of the incoming positron beam.

33523 (ANL/ASD/CP–78293) **An improved thermionic microwave gun and emittance-preserving transport line.** Borland, M. Argonne National Lab., IL (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–314: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017739. Source: OSTI; NTIS; INIS; GPO Dep.

The positron/electron linac for the Advanced Photon Source (APS) at Argonne National Laboratory can be used to accelerate electrons to 650 MeV. As part of a project to use this linac to test the quality of insertion devices, work has been done to develop a higher-brightness thermionic microwave gun of the SSRL type. The new gun design has smaller emittance by a factor of 3 to 4. The ratio of cathode field to maximum surface field is more than doubled. The new alpha-magnet-based transport line design produces negligible emittance degradation due to chromatic aberrations, in spite of the ±5% momentum spread.

33524 (ANL/ASD/CP–78294) **Design and measurement of the sextupole magnet for the APS storage rings.** Turner, L.R.; Thompson, K.M.; Kim, S.H.; Kim, K. Argonne National Lab., IL (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–296: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017423. Source: OSTI; NTIS; INIS; GPO Dep.

A prototype sextuple magnet has been designed, constructed, and measured for the storage ring of the Advanced Photon Source. The design approaches very closely to 120° rotation symmetry, in order to minimize all forbidden multipole components. The core is made of three identical stacks of laminations, each lamination consisting of two poles and the return yoke joining them. The antechamber of the thick aluminum vacuum chamber fits between two neighboring stacks. Computations and measurements of the sextupole strength B″ and multipole field components, both in the central region and integrated in the beam direction, show that the magnets meets the requirements for positron beam dynamics.

33525 (ANL/ASD/CP–78297) **Effect of magnet sorting using a simple resonance cancellation method on the RMS orbit distortion at the APS injector synchrotron.** Lopez, F.; Koul, R.; Mills, F.E. Argonne National Lab., IL (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–285: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017429. Source: OSTI; NTIS; INIS; GPO Dep.

The Advanced Photon Source injector synchrotron is a 7-GeV positron machine with a standard alternating gradient lattice. The calculated effect of dipole magnet strength errors on the orbit distortion, simulated by Monte Carlo, was reduced by sorting pairs of magnets having the closest simulated measured strengths to reduce the driving the term of the integer resonance nearest the operating point. This method resulted in a factor of four average reduction in the rms orbit distortion when all 68 magnets were sorted at once. The simulated effect of magnet measurement experimental resolution was found to limit the actual improvement. The B-beat factors were similarly reduced by sorting the quadrupole magnets according to their gradients.

33526 (ANL/ASD/CP–78301) **Tracking studies of insertion device effects on dynamic aperture in the APS storage ring.** Chae, Yong-chul; Crosbie, E.A. Argonne National Lab., IL (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–279: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017438. Source: OSTI; NTIS; INIS; GPO Dep.

We studied the effects of an insertion device (ID) on the dynamic aperture in the 7-GeV Advanced Photon Source (APS) storage ring using the program RACETRACK. We found that the nonlinear effect of the ID is the dominant effect on the dynamic aperture reduction compared to the other multipole errors which exist in the otherwise ideal lattice. The previous study of dynamic aperture was based on the assumption that the effect of the fast oscillating terms in L. Smith's Hamiltonian is small, and hence can be neglected in the simulation. The remarkable agreement between the previous study and the current results using RACETRACK, including all effects of the fast oscillating terms, justified those assumptions at least for the APS ring.

33527 (ANL/ASD/CP–78302) **Magnetic measurements of the storage ring quadrupole magnets for the 7-GeV Advanced Photon Source.** Kim, S.H.; Kim, K.; Doose, C.; Hogrefe, R.; Merl, R. Argonne National Lab., IL (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–286: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017457. Source: OSTI; NTIS; INIS; GPO Dep.

The pre-production quadrupole magnet for the Advanced Photon Source (APS) storage ring has been used. The multipole coefficients meet the tolerance requirements. The field-gradient integrals are measured relative to a reference quadrupole. By using two laser beam units, the magnetic and geometrical axes of the magnet are aligned within 0.2 mrad. The dependencies of the sextupole coefficient and the magnetic center on the excitation current are corrected by shunting the magnetic potentials of the top and bottom yokes.

33528 (ANL/ASD/CP–78325) **Status of the Advanced Photon Source (APS) linear accelerator.** White, M.; Berg, W.; Fuja, R.; Grelick, A.; Mavrogenes, G.; Nassiri, A.; Russell, T.; Wesolowski, W. Argonne National Lab., IL (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–328: International particle accelerator conference; 1993 meeting of Korea Accelerator and Plasma Research Association, Washington, DC (United States); Daejon (Korea, Republic of), 17-20 May 1993; 30 jun 1993; CONF-9306229–1). Order Number DE93018586. Source: OSTI; NTIS; INIS; GPO Dep.

A 2856-MHz S-band, 450-MeV electron/positron linear accelerator is the first part of the injector for the Advanced Photon Source (APS) 7-GeV storage ring. Construction of the APS linac is currently nearing completion, and commissioning will begin in July 1993. The linac and its current status are discussed in this paper.

33529 (ANL/ASD/CP–78326) **Distributed Non-evaporable Getter pumps for the storage ring of the APS.** Dortwegt, R.; Benaroya, R. Argonne National Lab., IL (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–312: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017751. Source: OSTI; NTIS; INIS; GPO Dep.

A pair of distributed Non-evaporable Getter (NeG) strip assemblies is installed in each of 236 aluminum vacuum chambers of the 1104-m storage ring of the Advanced Photon Source. Distributed pumping is provided to remove most of the gas resulting from photon-stimulated desorption occurring along the outer walls of the chambers. This is an efficient way of pumping because conductance is limited along the beam axis. The St-707 NeG strips are

conditioned at 450°C for 45 min. with 42 A. Base pressures obtained are also as low as 4×10^{11} Torr. The NeG strip assemblies are supported by a series of electrically isolated, 125-mm-long, interlocking stainless steel carriers. These unique interlocking carrier elements provide flexibility along the vacuum chamber curvature (r=38.96 m) and permit removal and installation of assemblies with as little as 150 mm external clearance between adjacent chambers.

33530 (ANL/ASD/CP–78330) **Measurement of beta-function and phase using the response matrix.** Chung, Y.; Decker, G.; Evans, K. Jr. Argonne National Lab., IL (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–316: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017701. Source: OSTI; NTIS; INIS; GPO Dep.

A new method for extracting the beta-function and phase for the beam position monitors (BPMs) and the corrector magnets from the measured response matrix is presented. The response matrix relates beam motion at the BPM locations to changes in corrector magnet strengths. Using the model beta and phase as the initial values, new values are obtained by iteration. The accuracy of beta and phase thus calculated is limited by the accuracy of response matrix measurement and calibration of BPMs and correctors. The scaling ambiguity in the beta-function is resolved by matching the beta product and phase advance across a drift region. A by-product of this technique is an accurate determination of the betatron tune, and in principle, quadrupole strengths can be calculated from the betas and phases. This method is applied to data obtained from the X-ray ring at the National Synchrotron Light Source at Brookhaven. The possibility of applying the results to lattice-debugging will also be discussed.

33531 (ANL/ASD/CP–78340) **A mm-wave planar microcavity structure for electron linear accelerator system.** Kang, Y.W. (Argonne National Lab., IL (United States)); Kustom, R.; Mills, F.; Mavrogenes, G.; Henke, H. Argonne National Lab., IL (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–292: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017691. Source: OSTI; NTIS; INIS; GPO Dep.

The muffin-tin cavity structure is planar and well suited for mm-wave accelerator with silicon etching techniques. A constant impedance traveling-wave structure is considered for design simplicity. The RF parameters are calculated and the shunt impedance is compared with the shunt impedance of a disk loaded cylindrical structure.

33532 (ANL/ASD/CP–78341) **Reduced length design of 9.8 MHz RF accelerating cavity for the positron accumulator ring (PAR) of the Advanced Photon Source (APS).** Kang, Y.W.; Bridges, J.F.; Kustom, R.L. Argonne National Lab., IL (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–315: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017703. Source: OSTI; NTIS; INIS; GPO Dep.

A 9.8-MHz RF accelerating cavity is developed for the first harmonic system in the APS PAR and an aluminum unit is tested. The design goal si 40 kV at the accelerating gap, Q-factor of $\sim$ 7,000 for the accelerating mode, 1.2-m diameter, 1.6-m length with good mechanical strength and stability. The design employs no dielectric or ferrite loading for tuning. The cavity is a plunger-loaded reentrant coaxial structure; the end of the inner conductor facing the wall has a piston-shaped loading structure which consists of a circular disk and a cylinder. The RF characteristic of the cavity was investigated using the URMEL-T and MAFIA programs. Compared with a coaxial structure with lumped element capacitive loading, this design gives improved RF characteristics.

33533 (ANL/ASD/CP–78342) **Frequency-feedback tuning for single-cell cavity under rf heating.** Stepp, J.D.; Bridges, J.F. Argonne National Lab., IL (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–349: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018566. Source: OSTI; NTIS; INIS; GPO Dep.

A tuning system is described that is being used to match the source frequency of a high-power klystron on the resonant frequency of the prototype single-cell cavity for the 7-GeV Advance Photon Source (APS) storage ring. Typically a water-cooled piston tuner is required to adjust the reactive component of the cavity's impedance to minimize reflected power back to the RF drive source. As the cavity watts expand due to RF heating, the resonant frequency decreases. Adjusting the source frequency to follow the cavity resonant frequency is a convenient method used to condition the cavity (for vacuum) at high power levels, in this case, 1 MV gap voltage at 100 kW power level. The tuning system consists of two coupling ports, a phase detector, a digitizing I/O system, and a DC coupled FM-modulated RF source. Proportional Integral Derivative (PID) loop parameters for the Experimental Physics and Industrial Control System (EPICS) software are calculated, and data is presented showing the damped response to peturbations on the loop. The timing system presented here does not need water-cooling, has no moving parts to wear out, and has an inherently faster response time. Its one limitation is the digitizing sampling rate. The only limitation in tuning range is the bandwidth of the RF source.

33534 (ANL/ASD/CP–78345) **Radiation measurements during cavities conditioning on APS RF test stand.** Grudzien, D.M.; Kustom, R.L.; Moe, H.J.; Song, J.J. Argonne National Lab., IL (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–311: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017696. Source: OSTI; NTIS; INIS; GPO Dep.

In order to determine the shielding structure around the Advanced Photon Source (APS) synchrotron and storage ring RF stations, the X-ray radiation has been measured in the near field and far field regions of the RF cavities during the normal conditioning process. Two cavity types, a prototype 352-MHz single-cell cavity and a 352-MHz five-cell cavity, are used on the APS and are conditioned in the RF test stand. Vacuum measurements are also taken on a prototype 352-MHz single-cell cavity and a 352-MHz five-cell cavity. The data will be compared with data on the five-cell cavities from CERN.

33535 (ANL/ASD/CP–78346) **Higher-order modes in the APS storage ring waveguides.** Brauer, S.O.; Kustom, R.L. Argonne National Lab., IL (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–312: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017702. Source: OSTI; NTIS; INIS; GPO Dep.

Twelve higher-order modes (HOMs) in the single-cell accelerating cavities for the Advanced Photon Source (APS) storage ring were calculated to have complex impedances that will cause coupled-bunched instabilities near or below the 300mA positron current which is the design goal. Some of these modes couple, through the coupling loop, from the storage ring cavity into the waveguide. This study investigates the transmission of these modes from the cavity into the waveguide. The standing wave ratio (VSWR) of a WR2300 hybrid waveguide component has been measured at each HOM frequency, and its effect on the transmitted modes in the waveguide is studied.

33536 (ANL/ASD/CP–78348) **Designing RF control subsystems using the VXIbus standard.** Stepp, J.D.; Vong, F.C.; Bridges, J.F. Argonne National Lab., IL (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–358: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018568. Source: OSTI; NTIS; INIS; GPO Dep.

Various components are being designed to control the RF system of the 7-GeV Advanced Photon Source (APS). The associated control electronics (phase shifters, amplitude modulators, phase detectors, automatic tuning control, and local feedback control) are

designed as modular cards with multiple channels for ease of replacement as well as for compact design. Various specifications of the VXIbus are listed and the method used to simplify the design of the control subsystem is shown. A commercial VXI interface board was used to speed the design cycle. Required manpower and actual task times are included. A discussion of the computer architecture and software development of the device drivers which allowed computer control from a VME processor located in a remote crate operating under the Experimental Physics and Industrial Controls Software (EPICS) program is also presented.

33537 (ANL/ASD/CP–78367) **Analysis and design of a high-current, high-voltage accurate power supply for the APS storage ring.** Fathizadeh, M. Argonne National Lab., IL (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–320: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018619. Source: OSTI; NTIS; INIS; GPO Dep.

There are 81 dipole magnets contained in the storage ring at the Advanced Photon Source (APS). These magnets are connected in series and are energized by only one 12-phase power supply. The eighty-first magnet is located in a temperature-controlled room with an NMR probe to monitor the magnetic field in the magnet and provide a reference signal for correction of the field drift due to aging of the components. The current in the magnets will be held at 497 A. The required current stability of the power supply is ±30 ppM, the current reproducibility is ±50 ppM, and the current ripple is ±400 ppM. The voltage required to maintain such a current in the magnets is about 1700 V. Different schemes for regulating current in the magnets are studied. Pspice software is used to simulate the behavior and the design of such a power supply under different conditions. The pros and cons of each scheme will be given and the proper power and regulating scheme will be selected.

33538 (ANL/ASD/CP–78368) **Control units for APS power supplies.** Despe, O.D.; Saunders, C.; McGhee, D.G. Argonne National Lab., IL (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–305: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017744. Source: OSTI; NTIS; INIS; GPO Dep.

The Advanced Photon Source (APS) accelerator facility is made up of five major subsystems in addition to the linac: the positron accumulator ring (PAR), low energy transport (LET), booster synchrotron (SYNCH), high energy transport (HET), the storage ring (SR). Each subsystem has multiple magnet power supply combinations, some requiring multiple of operation. These magnet and power supply combinations computer controlled and monitored. The power supply control unit (PSCU) is the first layer of hardware and software above the power supply itself and is described in this paper. The description includes the basic philosophy for each of operation and how it influences the topology and of implementing control. The design of the analog reference blocks (ARBs) influenced the design of other custom functions well as the feedback controls for vibration and other dynamic corrections. The command set supported by the PSCU is discussed.

33539 (ANL/ASD/CP–78533) **Rf-synchronized imaging for particle and photon beam characterizations.** Lumpkin, A.H. Argonne National Lab., IL (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–309: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017698. Source: OSTI; NTIS; INIS; GPO Dep.

The usefulness of imaging electro-optics for rf-driven accelerators can be enhanced by synchronizing the instruments to the system fundamental frequency or an appropriate subharmonic. This step allows one to obtain micropulse bunch length and phase during a series of linac bunches or storage ring passes. Several examples now exist of the use of synchroscan and dual-sweep streak cameras and/or image dissector tubes to access micropulse scale phenomena (10 to 30 ps) during linac and storage ring operations in the US, Japan, and Europe. As space permits, selections will be presented from the list of phase stability phenomena on photoelectric injectors, micropulse length during a macropulse, micropulse elongation effects, transverse Wakefield effects within a micropulse, and submicropulse phenomena on a stored beam. Potential applications to the subsystems of the Advanced Photon Source (APS) will be briefly addressed.

33540 (ANL/ASD/CP–78534) **Characterization techniques for the high-brightness particle beams of the Advanced Photon Source (APS).** Lumpkin, A.H. Argonne National Lab., IL (United States). [1993]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930722–16: Annual meeting of the Society of Photo-Optical Instrumentation Engineers (SPIE), San Diego, CA (United States), 11-16 Jul 1993). Order Number DE93018574. Source: OSTI; NTIS; INIS; GPO Dep.

The Advanced Photon Source (APS) will be a third-generation synchrotron radiation (SR) user facility in the hard x-ray regime (10–100 keV). The design objectives for the 7-GeV storage ring include a positron beam natural emittance of 8×10^{-9} m-rad at an average current of 100 mA. Proposed methods for measuring the transverse and longitudinal profiles will be described. Additionally, a research and development effort using an rf gun as a low-emittance source of electrons for injection into the 200- to 650-MeV linac subsystem is underway. This latter system is projected to produce electron beams with a normalized, rms emittance of ~2 π mm-mrad at peak currents of near one hundred amps. This interesting characterization problem will also be briefly discussed. The combination of both source types within one laboratory facility will stimulate the development of diagnostic techniques in these parameter spaces.

33541 (ANL/ASD/CP–78751) **Some closed-form solutions of the temperature field due to bending magnet and undulator heating in APS.** Sheng, I.C.; Nian, T. Argonne National Lab., IL (United States). [1993]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930722–13: Annual meeting of the Society of Photo-Optical Instrumentation Engineers (SPIE), San Diego, CA (United States), 11-16 Jul 1993). Order Number DE93017400. Source: OSTI; NTIS; INIS; GPO Dep.

Several temperature field solutions due to bending magnet and undulator x-ray heating are developed and presented in this paper. The Gaussian power distribution is simulated as the bending magnet whereas a Guassian-parabolic type of power distribution is used for the undulator/wiggler heating. The heating on a two-dimensional plane, three-dimensional block, thin disk, infinite wedge plane, infinite wedge block, and beryllium-copper composite are analyzed. Parametric studies are also included to determine the optimized temperature.

33542 (ANL/ASD/CP–79828) **Study of 1 MW neutron source synchrotron dual frequency power circuit for the main ring magnets.** McGhee, D.G. Argonne National Lab., IL (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9305177–9: 12. International collaboration of advanced neutron sources meeting (ICANS), Abingdon (United Kingdom), 24-28 May 1993). Order Number DE93017736. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes the proposed design of the resonant power circuits for the 1-MW neutron source synchrotron's main ring magnets. The synchrotron is to have a duty cycle of 30 Hz with a maximum upper limit of operation corresponding to 2.0 GeV and a maximum design value of 2.2 GeV. A stability of 30 ppM is the design goal for the main bending and focusing magnets (dipoles and quadruples), in order to achieve an overall stabffity of 100 ppm when random field and position errors of the magnets are included. The power circuits of this design are similar to those used in Argonne's Intense Pulsed Neutron Source (IPNS) where the energy losses during each cycle are supplied by continuous excitation from modulated multiphase DC power supplies. Since only 50% of the 30-Hz sinewave is used for acceleration, a dual-frequency resonant magnet circuit is used in this design. The 30-Hz repetition rate is maintained with a 20-Hz magnet guide field during acceleration and a 60-Hz reset field when no beam is present. This lengthens the guide-field rise time and shortens the fall time, improving the duty factor for acceleration. The maximum B dot is

reduced by 33% during acceleration and hence, the maximum rf voltage/turn is reduced by 56%.

33543 (ANL/ASD/CP–79833) **Rf capture studies for injection into a synchrotron.** Lessner, E.S.; Cho, Y. Argonne National Lab., IL (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–297: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017421. Source: OSTI; NTIS; INIS; GPO Dep.

The capture process for a rapid cycling protron synchrotron is studied by numerical simulation. The rf-programming is optimized to allow efficient capture such that minimum particle losses and reasonable capture voltage are attained. The total capture time is constrained to be less than 700 μseconds. Two methods of trapping the injected beam by the synchrotron rf system are examined: by stationary adiabatic capture and by synchronous injection in a standing bucket of the ring. In the adiabatic method, the non-linear function of Lilliequist and Symon is employed. The simulation allows the "tracking back" of the original distribution of any set of particles, in particular of those not captured at a given time, which is useful in studying injection alternatives such as shaping the phase-space density prior to injection. The simulation results will be used to design a chopper system to facilitate loss-free injection.

33544 (ANL/ASD/VU–78283) **A fifth harmonic rf bunch monitor for the ANL-APS electron linac.** Nassiri, A.; Grelick, A. Argonne National Lab., IL (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–287: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017476. Source: OSTI; NTIS; INIS; GPO Dep.

The function of a fifth harmonic (14.28 GHz) bunch monitor is to provide a signal which is proportional to the electron beam bunch size. The monitoring of the rf power signal at 14.28 GHz enables the operator to optimize the rf bunching of the beam at the end of the first accelerating section where the full bunching has been formed and remains mainly constant in size throughout the rest of the electron linac. A modified version of the SLAC original bunch monitor has been fabricated and its rf properties measured. This paper describes the design and the initial measurement results.

33545 (ANL/EP/CP–78284) **An ion-source model for first-order beam dynamic codes.** Fink, C.L.; Curry, B.P. Argonne National Lab., IL (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–346: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018613. Source: OSTI; NTIS; INIS; GPO Dep.

A model of a plasma ion source has been developed that approximates the system of Poisson and Boltzmann-Vlasov equations normally used to describe ion sources by an external electric field, a collective electric field due to the charge column, and the starting boundary conditions. The equations of this model can be used directly in the Lorentz force equation to calculate trajectories without iteration.

33546 (ANL/EP/CP–78373) **Design considerations for high-current superconducting RFQ,s.** Delayen, J.R.; Bohn, C.L.; Kennedy, W.L.; Sagalovsky, L. Argonne National Lab., IL (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–333: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018582. Source: OSTI; NTIS; INIS; GPO Dep.

As part of our ongoing development program of high-current cw accelerators, we are investigating the use of superconducting RFQs to capture, bunch, and accelerate high-current, cw ion beams to energies where they can be further accelerated by more conventional independently-coupled superconducting cavities. This investigation addresses issues related to beam physics, thermal management, electromagnetic design, mechanical design, matching to the ion source, etc.

33547 (ANL-HEP-CP–93-40) **Control, timing, and data acquisition for the Argonne Wakefield Accelerator (AWA).** Schoessow, P.; Ho, C.; Power, J.; Chojnacki, E. Argonne National Lab., IL (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–326: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018585. Source: OSTI; NTIS; INIS; GPO Dep.

The AWA is a new facility primarily designed for wakefield acceleration experiments at the 100 MV/m scale, which incorporates a high current linac and rf photocathode electron source, a low emittance rf electron gun for witness beam generation, and associated beamlines and diagnostics. The control system is based on VME and CA-MAC electronics interfaced to a high performance workstation and provides some distributed processing capability. In addition to the control of linac rf, laser optics, and beamlines, the system is also used for acquisition of video data both from luminescent beam position monitors and from streak camera pulse length diagnostics. Online image feature extraction will permit wakefields to be computed during the course of data taking. The linac timing electronics and its interface to the control system is described.

33548 (ANL-HEP-CP–93-41) **The Argonne Wakefield Accelerator (AWA) laser system and its laser pulse shaper.** Gai, W.; Hill, N.; Ho, C.; Schoessow, P.; Simpson, J. Argonne National Lab., IL (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–326: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018583. Source: OSTI; NTIS; INIS; GPO Dep.

Generating a 100 nC, 20 ps (FWHM) pulse length electron beam at the AWA requires a stable laser system capable of producing 1–3 ps, 1 mJ pulses at 248 nm and the capability of shaping the wave front. A wave front shaping device has been designed and built. It consists of nine concentric cylindrical mirrors. Each cylinder's position can be adjusted relative to the others by a system of computer controlled stepping motors. The reflecting surfaces were optically polished and dielectric coated. Detailed characterizations of the laser pulse shaper's performance using a streak camera and its associated optics are presented.

33549 (ANL-HEP-CP–93-44) **Construction of a high resolution electron beam profile monitor.** Norem, J.; Dawson, J.; Haberichter, W.; Novak, W.; Reed, L.; Yang, X.F. Argonne National Lab., IL (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–368: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018622. Source: OSTI; NTIS; INIS; GPO Dep.

Bremsstrahlung from an electron beam on a heavy target can be used to image the beam profile using collimators and slits. The limiting resolution using this system is determined by Fresnel diffraction, and is $\sim \sqrt{(\lambda d/2)}$, where λ is the photon wavelength and d is determined by the linear dimensions of the system. For linear colliders this resolution could be a few nm. The highest resolution requires detectors which see only high energy, (small λ), photons, and this is accomplished by converting photons to pairs, and detecting Cherenkov light in a nearly forward angle with a CCD detector or streak camera. Tests are planned at the Argonne APS and SLAC FFTB.

33550 (ANL/IPNS/CP–78911) **A parametric formulation of the resolution function of a pulsed-source chopper spectrometer.** Loong, C.K. (Argonne National Lab., IL (United States)); Carpenter, J.M.; Ikeda, S. Argonne National Lab., IL (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9305177–11: 12. International collaboration of advanced neutron sources meeting (ICANS), Abingdon (United Kingdom), 24-28 May 1993). Order Number DE93017797. Source: OSTI; NTIS; GPO Dep.

Based on a previously developed formulation for the resolution function of a pulsed-source chopper spectrometer, we describe an algorithm which facilitates the application of resolution calculations in data analysis. The method consists of an estimate of the source pulse shape parameters from a least-squares analysis of the monitor spectra and an efficient evaluation of the spectrometer resolution functions over a wide range of energy transfers using a parametric expression.

33551 (ANL/IPNS/CP–78912) **The use of chopper spectrometers for cold-to-epithermal neutron scattering at IPNS.** Loong, C.K.; Donley, L.I.; Ostrowski, G.E.; Kleb, R.; Hammonds, J.P.; Soderholm, L.; Takahashi, S. Argonne National Lab., IL (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9305177–10: 12. International collaboration of advanced neutron sources meeting (ICANS), Abingdon (United Kingdom), 24-28 May 1993). Order Number DE93017798. Source: OSTI; NTIS; INIS; GPO Dep.

A multi-detector chopper spectrometer enables measurements of the scattering function S(Q,E) to be made over a wide range of momentum and energy transfer (Q,E). The application of pulsed-source chopper spectrometers for inelastic measurements at thermal and epithermal energies (50 meV < E < 1000 meV) is well known. Recently at IPNS, we have extended the energy-transfer region down to about 0.5 meV with a resolution of the order of 150 μeV. It is made possible by utilizing the cold-neutron incident spectrum of the 100 K methane moderator in conjunction with a dual beryllium-body rotor system. Neutron incident energies can be changed efficiently over the 4 to 1000 meV region while maintaining an undisturbed sample environment. We describe the operation of the IPNS chopper spectrometers (HRMECS and LRMECS), the instrumental resolution and the background-suppression performance. The capability of measuring inelastic features from 0.5 to 100 meV with an energy resolution of $\Delta E/E_0$ = 2.5% is demonstrated by experimental results of crystal-field excitation spectra of a high-Tc superconductor $ErBa_2Cu_3O_7$. Preliminary data of quasielastic scattering from a room-temperature molten salt $AlCl_3$-EMIC are presented.

33552 (ANL/PHY/CP–78195) **Operational status of the uranium beam upgrade of the ATLAS accelerator.** Pardo, R.C.; Bollinger, L.M.; Nolen, J.A. Argonne National Lab., IL (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–359: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018567. Source: OSTI; NTIS; INIS; GPO Dep.

The Positive-Ion Injector (PII) for ATLAS is complete. First beams from the new injector have been accelerated and used for experiments at ATLAS. The PH consists of an ECR ion source on a 350-kV platform and a low-velocity superconducting linac. The first acceleration of uranium for the experimental program has demonstrated the design goals of the project have been met. Since the summer of 1992, the new injecter has been used for the research program approximately 50% of the time. Longitudinal beam quality from the new injector has been measured to be significantly better than comparable beams from the tandem injecter. Changes to the mix of resonators in the main ATLAS accelerator to match better the velocity profile for heavy beams such as uranium are nearly complete and uranium energies up to 6.45 MeV per nucleon have been achieved. The operating experience of the new ATLAS facility will be discussed with emphasis on the measured beam quality as well as achieved beam energies and currents.

33553 (ANL/PHY/CP–78214) **Niobium coaxial quarter-wave cavities for the New Delhi booster linac.** Shepard, K.W. (Argonne National Lab., IL (United States)); Roy, A.; Potukuchi, P.N. Argonne National Lab., IL (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–281: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017426. Source: OSTI; NTIS; INIS; GPO Dep.

This paper reports the design and construction status of a prototype superconducting niobium accelerating structure consisting of a pair of quarter-wave coaxial-line cavities which are strongly coupled with a superconducting loop. Quarter-wave resonators are two-gap accelerating structures and are relatively short, so that a large number of independently-phased cavities is required for a linac. Strongly coupling several cavities can reduce the number of independently-phased elements, but at the cost of reducing the range of useful velocity acceptance for each element. Coupling two cavities splits the accelerating rf eigenmode into two resonant modes each of which covers a portion of the full velocity acceptance range of the original single cavity mode. Using both of these resonant modes makes feasible the use of coupled cavity pairs for a linac with little loss m velocity acceptance. Design details for the niobium cavity pair and the results of preliminary tests of multipacting behavior are discussed.

33554 (ANL/PHY/CP–78215) **Construction of a superconducting RFQ structure.** Shepard, K.W. (Argonne National Lab., IL (United States)); Kennedy, W.L.; Crandall, K.R. Argonne National Lab., IL (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38 ;FG03-91ER81098. (CONF-930511–280: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017427. Source: OSTI; NTIS; INIS; GPO Dep.

This paper reports the design and construction status of a niobium superconducting RFQ operating at 194 MHz. The structure is of the rod and post type, novel in that each of four rods is supported by two posts oriented radially with respect to the beam axis. Although the geometry has four-fold rotation symmetry, the dipole-quadrupole mode splitting is large, giving good mechanical tolerances. The simplicity of the geometry enables designing for good mechanical stability while minimizing tooling costs for fabrication with niobium. Design details of a prototype niobium resonator, results of measurements on room temperature models, and construction status are discussed.

33555 (ANL/XFD/CP–78532) **Thermo-mechanical failure criteria for x-ray windows and filters and comparison with experiments.** Wang, Z.; Kuzay, T.M. Argonne National Lab., IL (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930722–10: Annual meeting of the Society of Photo-Optical Instrumentation Engineers (SPIE), San Diego, CA (United States), 11-16 Jul 1993). Order Number DE93017687. Source: OSTI; NTIS; INIS; GPO Dep.

Synchrotron x-ray windows are vacuum separators and are usually made of thin beryllium metal. Filters are provided upstream of the window to filter out the soft x-rays to protect the window from overheating and failing. The filters are made of thin carbon products or sometimes beryllium, the same material as the window. Because the window is a vacuum separator, understanding its potential structural failure under thermal load is very important. Current structural failure models for the brazed windows and filters under thermal stresses are not very accurate. Existing models have been carefully examined and found to be inconsistent with the actual failure modes of windows tested. Due to the thinness of the filter/window, the most likely failure mode is thermal buckling. In fact, recent synchrotron tests conducted in Japan on window failures bear out this position. In this paper, failure criteria for filters/windows are proposed, and analyses are performed and compared with the experimental results from various sources. A consistent result is found between the analysis and reported experiments. A series of additional analyses based on the proposed failure criteria is also carried out for filter and window designs for the third generation synchrotron beamline front ends. Comparative results are presented here.

33556 (ANL/XFD/CP–78584) **Mossbauer spectroscopy with synchrotron radiation.** Alp, E.E.; Mooney, T.M.; Toellner, T.; Sturhahn, W. Argonne National Lab., IL (United States). Jul 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930195–3: 2. Nassau Moessbauer conference, Garden City, NY (United States), 8 Jan 1993). Order Number DE93019753. Source: OSTI; NTIS; INIS; GPO Dep.

The principles underlying observation of the Mossbauer effect with synchrotron radiation are explained. The current status of the field is reviewed, and prospects for dedicated experimental stations on third generation machines are discussed.

33557 (BNL–48231) **Results from commissioning the AGS Booster orbit system.** Bleser, E. Brookhaven National Lab., Upton, NY (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-930511–122: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93014304. Source: OSTI; NTIS; INIS; GPO Dep.

This note reports results from the commissioning of three systems in the AGS Booster. The beam position monitor system, which works to a relative accuracy of 0.36 millimeters; the uncorrected Booster orbit, which has quite large excursions; and the passive eddy current correction system, which eliminates all but a few percent of the eddy current dipole effect.

33558 (BNL–49141) **NSLS Control Monitor and its upgrade.** Ramamoorthy, S.; Smith, J.D. Brookhaven National Lab., Upton, NY (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-930511–293: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017707. Source: OSTI; NTIS; INIS; GPO Dep.

The NSLS Control Monitor is a real-time operating system designed for the microprocessor subsystems that control the machine hardware in the NSLS facility. Its major functions are to control the hardware in response to the commands from the host computers, monitor hardware status and report errors to the alarm handler. The software originally developed for the Multibus micros has been upgraded to run on the VME-based systems. The upgraded monitor provides ethernet communication with the new system and serial link with the old system. The dual link is the key feature for a smooth and nondisruptive transition at all levels of the control system. This paper describes the functions of the various modules of the monitor and future plans.

33559 (BNL–49169) **Automatic emittance measurement at the ATF.** Wang, X.J.; Malone, R.; Batchelor, K.; Ben-Zvi, I. Brookhaven National Lab., Upton, NY (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-930511–289: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017573. Source: OSTI; NTIS; INIS; GPO Dep.

An automatic emittance measurement system to characterize the transverse emittance of the electron beam produced by the BNL photocathode electron gun is described. The system utilize a VAX workstation and a Spiricon beam analyzer. A operator window (created through the Vista control software package) controls the emittance measurement system and the graphic presentation of the results. Quadrupole variation method is used for the ATF automatic emittance measurement system. A simple emittance formula was derived to study the performance of the quadrupole variation method, and compared with the ATF experimental data is also presented.

33560 (BNL–49173) **Tune measurement in the NSLS booster synchrotron.** Blum, E.B.; Nawrocky, R. Brookhaven National Lab., Upton, NY (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-930511–299: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017575. Source: OSTI; NTIS; INIS; GPO Dep.

The NSLS booster synchrotron can accelerate an electron beam from approximately 80 to 750 MeV in 0.7 sec. The betatron tunes can change during acceleration by as much as 0.1 units, causing beam loss as they cross resonance lines. Precise measurements with a conventional swept spectrum analyzer have always been difficult because of the rapid variation of tune as the magnets are ramped. We are now using a system based on a Tektronix 3052 digital spectrum analyzer that can obtain a complete frequency spectrum over a 10 MHz bandwidth in 200 μsec. Betatron oscillations are stimulated for the measurements by applying white noise to the beam through stripline electrodes. We will describe the instrumentation, our measurements of tune as a function time during the acceleration cycle, and the resulting improvements to the booster operation.

33561 (BNL–49175) **Polarized wiggler for NSLS X-ray ring.** Friedman, A.; Zhang, X.; Krinsky, S.; Blum, E.B. Brookhaven National Lab., Upton, NY (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-930511–300: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017574. Source: OSTI; NTIS; INIS; GPO Dep.

We examine the properties of an elliptically polarized wiggler that will generate circularly polarized photons with energy spectrum of 3–12 KeV. The vertical wiggler magnetic field is produced by permanent magnets while the horizontal wiggler field is generated by electric coils capable of AC excitation. The radiation parameters of the wiggler is discussed. We consider AC excitation of the wiggler to produce the time modulation of the elliptic polarization. The power is dissipated in the vacuum chamber due to the eddy current.

33562 (BNL–49264) **Data acquisition system for Experiment E866 at the Brookhaven AGS.** Ashktorab, K.; LeVine, M.J.; Scheetz, R.A. Brookhaven National Lab., Upton, NY (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-930640–5: 8. IEEE conference on real-time computer applications in nuclear, particle and plasma physics, Vancouver (Canada), 8-11 Jun 1993). Order Number DE93018822. Source: OSTI; NTIS; INIS; GPO Dep.

Experiment E866 consists of two spectrometers and related detectors for investigations of collisions of relativistic beams of Au ions with fixed targets at the Brookhaven AGS. The data acquisition system, consisting of 11 CPUs in a single VME crate, gathers data from 8 Camac crates and 6 Fastbus crates.

33563 (BNL–49307) **The RHIC cryogenic control system.** Farah, Y.; Sondericker, J. Brookhaven National Lab., Upton, NY (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-930703–20: International cryogenic engineering conference and international cryogenic materials conference, Albuquerque, NM (United States), 12-16 Jul 1993). Order Number DE93018825. Source: OSTI; NTIS; GPO Dep.

A cryogenic process control system for the RHIC Project is discussed. It is independent of the main RHIC Control System, consisting of an upgrade of the existing 24.8 Kw helium refrigerator control section with the addition of a ring control section that regulates and monitors all cryogenic signals in the RHIC tunnel. The system is fully automated, which can run without the continuous presence of operators.

33564 (BNL–52321, pp. 63-84) **Neurocomputing methods for pattern recognition in nuclear physics.** Gyulassy, M. (Lawrence Berkeley Lab., CA (US)); Dong, D.; Harlander, M. Brookhaven National Lab., Upton, NY (United States). [1991]. DOE Contract AC03-76SF00098. (CONF-9110232–: Symposium on Relativistic Heavy Ion Collider (RHIC) detector R&D, Upton, NY (United States), 10-11 Oct 1991). In *Proceedings of the symposium on RHIC detector R&D.* 246p. Order Number DE93010855. Source: OSTI; NTIS; INIS.

We review recent progress on the development and applications of novel neurocomputing techniques for pattern recognition problems of relevance to RHIC experiments. The Elastic Tracking algorithm is shown to achieve sub-pad two track resolution without preprocessing. A high pass neural filter is developed for jet analysis and singular deconvolution methods are shown to recover the primordial jet distribution to a surprising high degree of accuracy.

33565 (BNL–52321, pp. 85-106) **The development of a silicon multiplicity detector system.** Beuttenmuller, R.H. (Brookhaven National Laboratory, Upton, NY (US)); Kraner, H.W.; Lissauer, D.; Makowiecki, D.; Polychronakos, V.; Radeka, V.; Sondericker, J.; Stephani, D.; Barrette, J.; Hall, J.; Mark, S.K.; Pruneau, C.A.; Wolfe, D.; Borenstein, S.R. Brookhaven National Lab., Upton, NY (United States). [1991]. (CONF-9110232–: Symposium on Relativistic Heavy Ion Collider (RHIC) detector R&D, Upton, NY (United States), 10-11 Oct 1991). In *Proceedings of the symposium on RHIC detector R&D.* 246p. Order Number DE93010855. Source: OSTI; NTIS; INIS.

The physics program and the design criteria for a Silicon Pad Detector at RHIC are reviewed. An end cap double sided readout detector configuration for RHIC is presented. Its performance as an on-line and off-line centrality tagging device is studied by means of simulations with Fritiof as the event generator. The results of an in-beam test of a prototype double-sided Si-detector are presented. Good signal-to-noise ratio are obtained with front junction and the

resistive back side readout. Good separation between one and two minimum-ionizing particle signals is achieved.

33566 (BNL–52321, pp. 107-135) **The vertex detector for the Lepton/Photon collaboration.** Sullivan, J.P. (Los Alamos National Lab., NM (US)); Boissevain, J.G.; Fox, D.; Hecke, H. van; Jacak, B.V.; Kapustinsky, J.S.; Leitch, M.J.; McGaughey, P.L.; Moss, J.M.; Sondheim, W.E. Brookhaven National Lab., Upton, NY (United States). [1991]. (CONF-9110232–: Symposium on Relativistic Heavy Ion Collider (RHIC) detector R&D, Upton, NY (United States), 10-11 Oct 1991). In *Proceedings of the symposium on RHIC detector R&D.* 246p. Order Number DE93010855. Source: OSTI; NTIS; INIS.

The conceptual design of the vertex detector for the Lepton/ Photon Collaboration at RHIC is described, including simulations of its expected performance. The design consists of two con- centric layers of single-sided Si strips. The expected performance as a multiplicity detector and in measuring the pseudo-rapidity (ν) distribution is discussed as well as the expected vertex finding efficiency and accuracy. Various options which could be used to reduce the cost of the detector are also discussed.

33567 (BNL–52321, pp. 137-152) **Simulations of silicon vertex tracker for star experiment at RHIC.** Odyniec, G. (Lawrence Berkeley Lab., CA (US)); Cebra, D.; Christie, W.; Naudet, C.; Schroeder, L.; Wilson, W.; Liko, D.; Cramer, J.; Prindle, D.; Trainor, T.; Braithwaite, W. Brookhaven National Lab., Upton, NY (United States). [1991]. (CONF-9110232–: Symposium on Relativistic Heavy Ion Collider (RHIC) detector R&D, Upton, NY (United States), 10-11 Oct 1991). In *Proceedings of the symposium on RHIC detector R&D.* 246p. Order Number DE93010855. Source: OSTI; NTIS; INIS.

The first computer simulations to optimize the Silicon Vertex Tracker (SVT) designed for the STAR experiment at RHIC are presented. The physics goals and the expected complexity of the events at RHIC dictate the design of a tracking system for the STAR experiment. The proposed tracking system will consist of a silicon vertex tracker (SVT) to locate the primary interaction and secondary decay vertices and to improve the momentum resolution, and a time projection chamber (TPC), positioned inside a solenoidal magnet, for continuous tracking.

33568 (BNL–52321, pp. 153-179) **Calirimeter/absorber optimization for a RHIC dimuon experiment.** Aronson, S.H. (Brookhaven National Lab., Upton, NY (US)); Murtagh, M.J.; Starks, M.; Liu, X.T.; Petitt, G.A.; Zhang, Z.; Ewell, L.A.; Hill, J.C.; Wohn, F.K.; Costales, J.B.; Namboodiri, M.N., Sangster, T.C.; Thomas, J.H.; Gavron, A.; Waters, L.; Kehoe, W.LBrookhaven National Lab., Upton, NY (United States). [1991]. (CONF-9110232–: Symposium on Relativistic Heavy Ion Collider (RHIC) detector R&D, Upton, NY (United States), 10-11 Oct 1991). In *Proceedings of the symposium on RHIC detector R&D.* 246p. Order Number DE93010855. Source: OSTI; NTIS; INIS.

The RD-10 R&D effort on calorimeter/absorber optimization for a RHIC experiment had an extended run in 1991 using the A2 test beam at the AGS. Measurements were made of the leakage of particles behind various model hadron calorimeters. Behavior of the calorimeter/absorber as a muon-identifier was studied. First comparisons of results from test measurements to calculated results using the GHEISHA code were made.

33569 (BNL–52321, pp. 181-192) **Applications of the lahet simulation code to relativistic heavy ion detectors.** Waters, L. (Los Alamos National Lab., NM (US)); Gavron, A. Brookhaven National Lab., Upton, NY (United States). [1991]. (CONF-9110232–: Symposium on Relativistic Heavy Ion Collider (RHIC) detector R&D, Upton, NY (United States), 10-11 Oct 1991). In *Proceedings of the symposium on RHIC detector R&D.* 246p. Order Number DE93010855. Source: OSTI; NTIS; INIS.

The Los Alamos High Energy Transport (LAHET) simulation code has been applied to test beam data from the lead/scintillator Participant Calorimeter of BNL AGS experiment E814. The LAHET code treats hadronic interactions with the LANL version of the Oak Ridge code HETC. LAHET has now been expanded to handle hadrons with kinetic energies greater than 5 GeV with the FLUKA code, while HETC is used exclusively below 2.0 GeV. FLUKA is phased in linearly between 2.0 and 5.0 GeV. Transport of electrons and photons is done with EGS4, and an interface to the Los Alamos HMCNP3B library based code is provided to analyze neutrons with kinetic energies less than 20 MeV. Excellent agreement is found between the test data and simulation, and results for 2.46 GeV/c protons and pions are illustrated in this article.

33570 (BNL–52321, pp. 193-202) **Highly segmented, high resolution time-of-flight system.** Nayak, T.K. (Columbia Univ., New York, NY (US)); Nagamiya, S.; Vossnack, O.; Wu, Y.D.; Zajc, W.A.; Miake, Y.; Ueno, S.; Kitayama, H.; Nagasaka, Y.; Tomizawa, K.; Arai, I.; Yagi, K. Brookhaven National Lab., Upton, NY (United States). [1991]. (CONF-9110232–: Symposium on Relativistic Heavy Ion Collider (RHIC) detector R&D, Upton, NY (United States), 10-11 Oct 1991). In *Proceedings of the symposium on RHIC detector R&D.* 246p. Order Number DE93010855. Source: OSTI; NTIS; INIS.

The light attenuation and timing characteristics of time-of-flight counters constructed of 3m long scintillating fiber bundles of different shapes and sizes are presented. Fiber bundles made of 5mm diameter fibers showed good timing characteristics and less light attenuation. The results for a 1.5m long scintillator rod are also presented.

33571 (BNL–52321, pp. 203-206) **Research and development on a sub 100 PICO second time-of-flight system based on silicon avalanche diodes.** Choi, Y. (Purdue Univ., West Lafayette, IN (US)); Hirsch, A.; Hauger, A.; Scharenberg, R.; Tincknell, M.; Rai, G. Brookhaven National Lab., Upton, NY (United States). [1991]. (CONF-9110232–: Symposium on Relativistic Heavy Ion Collider (RHIC) detector R&D, Upton, NY (United States), 10-11 Oct 1991). In *Proceedings of the symposium on RHIC detector R&D.* 246p. Order Number DE93010855. Source: OSTI; NTIS; INIS.

Particle identification requires a momentum measurement and a second independent determination either energy loss (dE/dx) or time of flight (TOF). To cover a momentum range from 0.1 GeV/c to 1.5 GeV/c in the STAR detector requires both the dE/dx and TOF techniques. This research is designed to develop the avalanche diode (AVD) detectors for TOF systems and evaluate their performance. The test of a small prototype system would be carried out at Purdue and at accelerator test beam sites. The Purdue group has developed a complete test setup for evaluating the time resolution of the AVD's which includes fast-slow electronic channels, CAMAC based electronic modules and a temperature controlled environment. The AVDs also need to be tested in a 0.5 tesla magnetic field. The Purdue group would augment this test set up to include a magnetic field.

33572 (BNL–52321, pp. 207-213) **Behavior of TPC's in a high particle flux environment.** Etkin, A. (Brookhaven National Lab., Upton, NY (US)); Eiseman, S.E.; Foley, K.J.; Hackenburg, R.W.; Longacre, R.S.; Love, W.A.; Morris, T.W.; Platner, E.D.; Saulys, A.C.; Lindenbaum, S.J.; Chan, C.S.; Kramer, M.A.; Zhao, K.H.; Zhu, Y.; Hallman, T.J.; MadanBrookhaven National Lab., Upton, NY (United States). [1991]. DOE Contract AC02-76CH00016 ;AC02-83ER40107 ;FG05-87ER40309. (CONF-9110232–: Symposium on Relativistic Heavy Ion Collider (RHIC) detector R&D, Upton, NY (United States), 10-11 Oct 1991). In *Proceedings of the symposium on RHIC detector R&D.* 246p. Order Number DE93010855. Source: OSTI; NTIS; INIS.

TPC's (Time Projection Chamber) used in E-810 at the TAGS (Alternating Gradient Synchrotron) were exposed to fluxes equivalent to more than 10 minimum ionizing particles per second to find if such high fluxes cause gain changes or distortions of the electric field. Initial results of these and other tests are presented and the consequences for the RHIC (Relativistic Heavy Ion Collider) TPC-based experiments are discussed.

33573 (BNL–52321, pp. 215-232) **Generic R&D on undoped cesium iodide and lead fluoride.** Kierstead, J.A. (Brookhaven National Lab., Upton, NY (US)); Levy, P.W.; Stoll, S.; Woody, C.L.; Goldberg, M.; Horwitz, N.; Skwarnicki, T.; Sobolewski, Z.; Anderson, D.F.; Ramberg, E.J.; Zimmerman, J. Brookhaven National Lab., Upton, NY (United States). [1991]. (CONF-9110232–: Symposium on Relativistic Heavy Ion Collider (RHIC) detector R&D,

Upton, NY (United States), 10-11 Oct 1991). In *Proceedings of the symposium on RHIC detector R&D.* 246p. Order Number DE93010855. Source: OSTI; NTIS; INIS.

A summary is given on the recent progress on generic R&D on undoped CsI and PbF_2. Both of these materials are being investigated for use as a high resolution electromagnetic calorimeter for RHIC, as well as for other potential applications. Results are given on the development of a low gain readout system for use with undoped CsI crystals. A study has also been made of radiation damage in both undoped and thallium doped CsI. The progress on the growth of large, high quality PbF_2 crystals, which would be suitable for calorimeter applications, is discussed, and some first test beam results with a prototype PbF_2 calorimeter are given. Finally, results are presented on the improved radiation resistance of the new PbF_2 material.

33574 (BNL–52321, pp. 233-246) **A transition radiation detector for RHIC featuring accurate tracking and dE/dx particle identification.** O'Brien, E. (Brookhaven National Lab., Upton, NY (US)); Lissauer, D.; McCorkle, S.; Polychronakos, V.; Takai, H.; Chi, C.Y.; Nagamiya, S.; Sippach, W.; Toy, M.; Wang, D.; Wang, Y.F.; Wiggins, C.; Willis, W.; Cherniatin, V.; Dolgoshein, B.; Bennett, M.; ChiBrookhaven National Lab., Upton, NY (United States). [1991]. (CONF-9110232–: Symposium on Relativistic Heavy Ion Collider (RHIC) detector R&D, Upton, NY (United States), 10-11 Oct 1991). In *Proceedings of the symposium on RHIC detector R&D.* 246p. Order Number DE93010855. Source: OSTI; NTIS; INIS.

We describe the results of a test ran involving a Transition Radiation Detector that can both distinguish electrons from pions which momenta greater titan 0.7 GeV/c and simultaneously track particles passing through the detector. The particle identification is accomplished through a combination of the detection of Transition Radiation from the electron and the differences in electron and pion energy loss (dE/dx) in the detector. The dE/dx particle separation is most, efficient below 2 GeV/c while particle ID utilizing Transition Radiation effective above 1.5 GeV/c. Combined, the electron-pion separation is-better than 5×10^2. The single-wire, track-position resolution for the TRD is $\sim$230 μm.

33575 (DOE/ER/40150–211) **Alignment of CEBAF cryomodules.** Schneider, W.J.; Bisognano, J.J.; Fischer, J. Southeastern Universities Research Association, Inc., Newport News, VA (United States). Continuous Electron Beam Accelerator Facility. Jun 1993. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84ER40150. (CEBAF-PR–93-017;CONF-930511–240: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017505. Source: OSTI; NTIS; INIS; GPO Dep.

CEBAF, the Continuous Electron Beam Accelerator Facility, when completed, will house a 4 GeV recirculating accelerator. Each of the accelerator's two linacs contains 160 superconducting radio frequency (SRF) 1497 MHz niobium cavities in 20 cryomodules. Alignments of the cavities within the cryomodule with respect to beam axis is critical to achieving the optimum accelerator performance. This paper discusses the rationale for the current specification on cavity mechanical alignment: 2 mrad (rms) applied to the 0.5 m active length cavities. We describe the tooling that was developed to achieve the tolerance at the time of cavity pair assembly, to preserve and integrate alignment during cryomodule assembly, and to translate alignment to appropriate installation in the beam line.

33576 (DOE/ER/40150–212) **Performance of production SRF cavities for CEBAF.** Reece, C.; Benesch, J.; Kneisel, P.; Kushnick, P.; Mammosser, J.; Powers, T. Southeastern Universities Research Association, Inc., Newport News, VA (United States). Continuous Electron Beam Accelerator Facility. Jun 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84ER40150. (CEBAF-PR–93-018;CONF-930511–268: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017367. Source: OSTI; NTIS; INIS; GPO Dep.

Construction of the Continuous Electron Beam Accelerator Facility recirculating linac represents the largest scale application of superconducting rf (SRF) technology to date. Over 250 of the eventual 338 SRF 1497 MHz cavities have been assembled into hermetic pairs and completed rf testing at 2.0 K. Although the rf performance characteristics well exceed the CEBAF baseline requirements of $Q_0 = 2.4 \times 10^9$ at 5 MV/m, the usual limiting phenomena are encountered field emission, quenching, Q-switching, will occasional multipacting. An analysis of the occurrence conditions and severity of these phenomena during production cavity testing is presented. The frequency with which performance is limited by quenching suggests that additional material advances may be required for applications which require the reliable achievement of accelerating gradients of more than 15 MV/m. The distributions of frequency and Q for a higher-order mode are also presented.

33577 (DOE/ER/40150–219) **Beam raster system at CEBAF.** Yan, C.; Beaufait, J.; Brindza, P.; Carlini, R.; Vulcan, W.; Wines, R. Southeastern Universities Research Association, Inc., Newport News, VA (United States). Continuous Electron Beam Accelerator Facility. [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84ER40150. (CEBAF-PR–93-005). Order Number DE93014225. Source: OSTI; NTIS; INIS; GPO Dep.

A cascade raster system will be used to generate variable rastering pattern on polarized target, cryogenic hydrogen target, and the beam dump with adjustable frequency up to 10 kHz and variable deflection angle from 0.05 mr to 1 mr. Each raster consists of two air-core bedstead coils providing transverse and vertival scans. The magnets are energized by individual MOS power amplifiers being controlled by the scan generator which determines frequency, amplitude, and phase shift between the cascade rasters.

33578 (DOE/ER/40150–220) **Beam energy measurement using the ARC beam line as a spectrometer.** Yan, C.; Carlini, R.; Neuffer, D. Southeastern Universities Research Association, Inc., Newport News, VA (United States). Continuous Electron Beam Accelerator Facility. [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84ER40150. (CEBAF-PR–93-004). Order Number DE93014226. Source: OSTI; NTIS; INIS; GPO Dep.

The use of the Hall C achromatic arc line as an energy analyser is proposed. It has a dispersion of 12cm/% with all the quadrupoles, sextupoles, and beam correctors switched off. The transverse position and the angle of the beam at the entrance of the arc is precisely measured by a pair of wire scanners spaced by 2.5 m, and the transverse position of the outgoing beam is measured by another pair of wire scanners at the exit of the arc. After the absolute beam energy is measured, the arc will be turned into normal achromat mode by energizing all the elements and the beam position probe located at the mid-point of the arc is used to monitor the beam energy in the operational mode. A complete error analysis shows that an absolute beam energy measurement with 10^{-3} accuracy can be achieved. Relative energy measurements at the 10^{-4} level are also obtainable.

33579 (DOE/ER/40150–224) **Performance of a 1500 MHz niobium cavity with 2K-LHe channel cooling.** Susta, J.; Kneisel, P.; Wiseman, M. Southeastern Universities Research Association, Inc., Newport News, VA (United States). Continuous Electron Beam Accelerator Facility. Jun 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84ER40150. (CONF-930511–294: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993; CEBAF-PR–93-024). Order Number DE93017452. Source: OSTI; NTIS; INIS; GPO Dep.

β=1 superconducting accelerator structures are traditionally operated immersed in a liquid helium bath. Nevertheless, several attempts have been made in the past to make use of the numerous operational and cost advantages of a pipe-cooling configuration: reduction in liquid helium inventory, minimized cooldown/warmup times, and elimination of the LHe-vessel, which reduces the sensitivity to microphonics and provides easier access to all cavity components. This paper reports on tests performed with a 1500 MHz niobium cavity with 2K-LHe cooling channels covering only a fraction of the cavity surface. The cooling channels are made of niobium to preserve the capability for high temperature treatments. In the initial test the cavity was immersed in a helium bath; subsequently the cooling was only provided by superfluid helium in the cooling channels. The experimental results are compared to thermal model calculations. In addition, the computer

model is used to investigate the variations in cavity performance as a function of the cooling channel geometry and thermal conductivity properties of the niobium.

33580 (DOE/ER/40150–226) **Integrated numerical modeling of a laser gun injector.** Liu, H.; Benson, S.; Bisognano, J.; Liger, P.; Neil, G.; Neuffer, D.; Sinclair, C.; Yunn, B. Southeastern Universities Research Association, Inc., Newport News, VA (United States). Continuous Electron Beam Accelerator Facility. Jun 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84ER40150. (CEBAF-PR–93-029;CONF-930511–317: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017820. Source: OSTI; NTIS; INIS; GPO Dep.

CEBAF is planning to incorporate a laser gun injector into the linac front end as a high-charge cw source for a high-power free electron laser and nuclear physics. This injector consists of a DC laser gun, a buncher, a cryounit and a chicane. The performance of the injector is predicted based on integrated numerical modeling using POISSON, SUPERFISH and PARMELA. The point-by-point method incorporated into PARMELA by McDonald is chosen for space charge treatment. The concept of "conditioning for final bunching" is employed to vary several crucial parameters of the system for achieving highest peak current while maintaining low emittance and low energy spread. Extensive parameter variation studies show that the design will perform beyond the specifications for FEL operations aimed at industrial applications and fundamental scientific research. The calculation also shows that the injector will perform as an extremely bright cw electron source.

33581 (DOE/ER/40150–T2) **Performance of a CEBAF production cavity after high-temperature heat treatment.** Kneisel, P.; Rao, M. Southeastern Universities Research Association, Inc., Newport News, VA (United States). Continuous Electron Beam Accelerator Facility. Jun 1993. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84ER40150. (CEBAF-PR–93-023). Order Number DE93017915. Source: OSTI; NTIS; INIS; GPO Dep.

CEBAF's production cavities are tested in a vertical configuration after appropriate chemical surface treatment prior to installation into the accelerator. The performance of these cavities is excellent, often exceeding the specifications of E_{acc}=5 MV/m at 2 K by factors of 2 to 3. In such cases the cavities are often limited by thermal-magnetic breakdown. A cavity that exhibited a limiting gradient of $E_{acc} \leq$ 16.4 MV/m has been heat-treated at 1400°C for 6 hours in the presence of titanium as a solid state gettering material to improve the thermal stability of the niobium. After the heat treatment a gradient of E_{acc}=20.5 MV/m corresponding to a peak surface electric field of E_{peak}=52 MV/m has been measured. In addition to the cavity results, data on thermal conductivity and tensile properties of samples which have undergone the same treatments as the cavity are reported.

33582 (DOE/ER/40541–1) **SSC detector muon sub-system beam tests.** Downing, R. (Illinois Univ., Urbana, IL (United States). Dept. of Physics); Errede, S.; Gauthier, A.; Haney, M.; Karliner, I.; Liss, T.; O'Halloran, T.; Sheldon, P.; Simiatis, V.; Thaler, J.; Wiss, J.; Green, D.; Martin, P.; Morfin, J.; Kunori, S.; Skuja,.Washington Univ., Seattle, WA (United States). Dept. of Physics. [1993]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG06-90ER40541. Order Number DE93018415. Source: OSTI; NTIS; INIS; GPO Dep.

We propose to start a test-beam experiment at Fermilab studying the problems associated with tracking extremely high energy muons through absorbers. We anticipate that in this energy range the observation of the muons will be complicated by associated electromagnetic radiation Monte Carlo simulations of this background need to be tuned by direct observations. These beam tests are essential to determine important design parameters of a SSC muon detector, such as the choice of the tracking, geometry, hardware triggering schemes, the number of measuring stations, the amount of iron between measuring stations, etc. We intend to begin the first phase of this program in November of 1990 utilizing the Tevatron muon beam. We plan to measure the multiplicity, direction, and separation of secondary particles associated with the primary muon track as it emerges from an absorber. The second phase of beam test in 1992 or later will be a full scale test for the final design chosen in our muon subsystem proposal.

33583 (DOE/FTR–93012116) **[Cryostat project meetings and vendor visits in Italy and Germany]: Foreign trip report, September 7–22, 1992.** Nicol, T.H. Fermi National Accelerator Lab., Batavia, IL (United States). 23 Sep 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. Order Number DE93012116. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of this trip was three-fold. First, to attend a cryostat working group meeting of the TESLA collaboration at INFN-Frascati, second to visit an Italian cryostat vendor whose charge is to design and fabricate cryostats for the TESLA test cell, and third to attend a scheduled TESLA collaboration workshop at DESY.

33584 (DOE/FTR–93017244) **Travel to England to discuss final design of the CLAS TORUS: Foreign trip report, June 5–10, 1992.** O'Meara, J.E.; Tuzel, W.; Bonneau, P.R. Southeastern Universities Research Association, Inc., Newport News, VA (United States). 15 Jun 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84ER40150. Order Number DE93017244. Source: OSTI; NTIS (US Sales Only); GPO Dep.

CEBAF visited Oxford Instrument, June 8 and 9, 1992, to discuss remain issues of final design of the CLAS TORUS. The following technical subjects were discussed during this meeting: Superconducting circuit design; coil structure; cryogenic and vacuum system; and power supply and control.

33585 (DOE/FTR–93017246) **Travel to Europe concerning quadrupole designs at Saclay: Foreign trip report, December 3, 1992–March 7, 1993.** Alcorn, J.; Gavalya, A. Southeastern Universities Research Association, Inc., Newport News, VA (United States). 21 Jul 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84ER40150. Order Number DE93017246. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report discusses the preliminary design of quadrupole magnets for the CEBAF accelerator.

33586 (FNAL/C–93/132) **Reliability of the Fermilab Antiproton Source.** Harms, E. Jr. Fermi National Accelerator Lab., Batavia, IL (United States). May 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-930511–308: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017807. Source: OSTI; NTIS; INIS; GPO Dep.

This paper reports on the reliability of the Fermilab Antiproton source since it began operation in 1985. Reliability of the complex as a whole as well as subsystem performance is summarized. Also discussed is the trending done to determine causes of significant machine downtime and actions taken to reduce the incidence of failure. Finally, results of a study to detect previously unidentified reliability limitations are presented.

33587 (FNAL-TM–1790) **Beam transfer at E0: An overview.** Saritepe, S. (Superconducting Super Collider Lab., Dallas, TX (United States)); Annala, G. Fermi National Accelerator Lab., Batavia, IL (United States). 25 Jun 1993. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. Order Number DE93017814. Source: OSTI; NTIS; INIS; GPO Dep.

The helical orbits in the Tevatron necessitated changes in the beam transfer operation between the Main Ring and the Tevatron. This document is intended to present an overview of the beam transfer with an emphasis on the recent changes. It will also serve as a bibliography for the other documents that exist on Tevatron injection.

33588 (FNAL-TM–1791) **Tevatron reverse injection.** Saritepe, S. (Superconducting Super Collider Lab., Dallas, TX (United States)); Annala, G. Fermi National Accelerator Lab., Batavia, IL (United States). 25 Jun 1993. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. Order Number DE93017813. Source: OSTI; NTIS; INIS; GPO Dep.

In the new injection scenario antiprotons are injected onto a helical orbit in the Tevatron in order to avoid the detrimental effects of the beam-beam interaction at 150 GeV. The new scenario required

changes in the tuning procedure. Antiprotons are too precious to be used for tuning, therefore the antiproton injection line has to be tuned with protons by reverse injecting them from the Tevatron into the Main Pang (MR). Previously, the reverse injection was performed in one supercycle. One batch of uncoalesced bunches was injected into the Tevatron and ejected after 40 seconds. Then the orbit closure was performed in the MR. In the new scheme the lambertson magnets have to be moved and separator polarities have to be switched, activities that cannot be completed in one supercycle. Therefore, the reverse injection sequence was changed. This involved the redefinition of TVBS dock event $D8 as MRBS $D8 thus marking it possible to inject 6 proton batches and eject them one at a time on command, performing orbit closure each time in the MR.

33589 (FNAL-TM–1836) **Electrical design note for a 5000 ADC, 230 μH power supply filter choke.** Visser, A.T. Fermi National Accelerator Lab., Batavia, IL (United States). Apr 1993. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. Order Number DE93014015. Source: OSTI; NTIS; INIS; GPO Dep.

This note describes the design of a 5000 ADC, 230 μH choke made from standard transformer cores. Five of these chokes have been made for CDF and MTF. NOTE: Special magnets can also be made using standard cores.

33590 (FNAL-TM–1847) **Impedance issue of corrugated beam pipe from CDF.** Ng, King-Yuen. Fermi National Accelerator Lab., Batavia, IL (United States). Jun 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. Order Number DE93017815. Source: OSTI; NTIS; INIS; GPO Dep.

The CDF collaboration proposed to install a new corrugated beam pipe at the Tevatron interaction area in order to better monitor the interaction vertex. This note discuss the impedance implication of such a pipe.

33591 (INIS-RU–347, pp. 387) **Improvement of the axial-symmetrical magnetic lens characteristics.** Balashov, V.I. (Kazakhskij Gosudarstvennyj Univ., Alma-Ata (Kazakhstan)); Fisenko, S.I. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. 3 refs., 1 tab. ELECTROMAGNETIC LENSES/electron beams; AXIAL SYMMETRY; FOCUSING; MAGNETIC FIELDS; PERFORMANCE

33592 (INIS-RU–347, pp. 391) **Investigation of resonance X-ray transition radiation of electrons in a laminated target.** Basaj, A.Yu. (Tomskij Gosudarstvennyj Univ., Tomsk (Russian Federation)); Vorob'ev, S.A.; Zabaev, V.N.; Kalinin, B.N.; Kaplin, V.V.; Uglov, S.R. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. 1 ref. ELECTRON BEAMS/transition radiation; ANGULAR DISTRIBUTION; BERYLLIUM; DACRON; KEV RANGE 10-100; MEV RANGE 100-1000; NAI DETECTORS; TARGETS; X RADIATION; X-RAY DETECTION

33593 (INIS-RU–347, pp. 402) **Multipurpose installation for applied investigation on the U-240 cyclotron.** Atamanchuk, I.G. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Bukanov, V.N.; Dryapachenko, I.P. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. ACCELERATOR FACILITIES/crystal doping; ACCELERATOR FACILITIES/neutron beams; BEAM MONITORING; BERYLLIUM; FARADAY CUPS; KIEV CYCLOTRON; MEV RANGE 10-100; MICRO AMP BEAM CURRENTS; NEUTRON FLUENCE; SILICON; TARGETS

33594 (INIS-RU–347, pp. 404) **Installation for measurement of surface heterogeneity of nuclear targets.** Voronin, A.S. (Radievyj Inst., Leningrad (Russian Federation)); Lashaev, S.I.; Solov'ev, S.M.; Soloshenkov, P.S. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. 1 ref. URANIUM 238 TARGET/surface coating; ALPHA DETECTION; CALIBRATION STANDARDS; HETEROGENEOUS EFFECTS; SI SEMICONDUCTOR DETECTORS; SURFACE BARRIER DETECTORS; TARGET CHAMBERS; TARGETS; THICKNESS

33595 (INIS-RU–347, pp. 420) **Installation for radiobiological investigations with correlated particle beams.** Lyubinskij, N.N. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Melenevskij, A.Eh.; Romanova, E.P.; Fedyuk, E.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. ION BEAMS/biological radiation effects; ACCELERATOR FACILITIES; BEAM BENDING MAGNETS; CORRELATIONS; CRACOW U-120 CYCLOTRON; IMIDES; IONIZATION CHAMBERS; POLYMERS; RADIOBIOLOGY; SPATIAL DOSE DISTRIBUTIONS; THIN FILMS

33596 (INIS-RU–355, pp. 116-119) **Electromagnetic disintegration of relativistic deuterons in amorphous and crystal targets and high-energy neutron beam formation.** Pivovarov, Yu.L. (Tomskij Politekhnicheskij Inst., Tomsk (Russian Federation). Inst. Yadernoj Fiziki, Ehlektroniki i Avtomatiki). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1992. (In Russian). (CONF-9102199–: All-Union meeting on problems of application of charged particles channeling effects in crystals in high-energy physics, Protvino (Russian Federation), 26-28 Feb 1991). In *Problems of application of charged particles channeling effects in crystals in high-energy physics: Proceedings of the All-Union meeting. Short communications.* 132p. Order Number DE93634023. Source: OSTI; NTIS (US Sales Only); INIS.

Estimations of neutron beam intensity production under electromagnetic desintegration of deuterons in amorphous cristalline targets are presented. 5 refs.; 2 figs.

33597 (KEK–92-17) **Accelerator shielding benchmark problems.** Hirayama, H. (and others); Ban, S.; Nakamura, T. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jan 1993. 166p. Order Number DE93520300. Source: OSTI; NTIS; INIS.

Accelerator shielding benchmark problems prepared by Working Group of Accelerator Shielding in the Research Committee on Radiation Behavior in the Atomic Energy Society of Japan were compiled by Radiation Safety Control Center of National Laboratory for High Energy Physics. Twenty-five accelerator shielding benchmark problems are presented for evaluating the calculational

algorithm, the accuracy of computer codes and the nuclear data used in codes. (author).

33598 (KEK–92-18) **Study on interstrand coupling losses in Rutherford-type superconducting cables.** Lei, Y.Z.; Shintomi, T.; Terashima, A.; Hirabayashi, H. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Feb 1993. 23p. Order Number DE93520301. Source: OSTI; NTIS; INIS.

Two sets of experimental apparatus for measuring the AC losses in superconducting strands and Rutherford-type cable conductors have been constructed. A few strand samples and a number of compacted cable samples with and without a CuMn matrix have been measured. The hysteresis loss, loss from coupling within strands and loss from coupling between strands in cables have been distinguished from each other. The results show that, even for Rutherford cables without any soldering and coating, their AC losses may be quite different from each other due to the variation of the interstrand coupling loss. For cables without a CuMn matrix, interstrand coupling loss increases nearly according to a geometrical series with an increase of curing temperature simulating coil fabrication. However, cables with the CuMn matrix show a relatively small curing temperature dependence. For most of the samples, losses do not show any evident dependence on the mechanical pressure. Interstrand resistances in one of these cables have also been measured; the results indicate that the tendency for a decrease in the interstrand resistances is consistent with the results of AC loss measurements. (author).

33599 (KEK-PR–92-2) **KENS report - 9, 1991/92.** Misawa, M.; Masuda, Y.; Ikeda, S. (eds.). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). 1992. 268p. Order Number DE93520302. Source: OSTI; NTIS; INIS.

The present issue follows a previous issue, KENS Report-VIII published in December 1990 and summarizes research progress at the KENS facility during the period between October 1990 and September 1992. During this period a great deal of efforts was devoted to improve the performance of the existing instruments. The construction of a small and medium-Q instrument, WINK, is almost completed and the instrument has successfully been utilized for the measurement of the micro void structure in SiC fiber, a new material. A glass and liquid spectrometer, HIT, which was very productive over past twelve years, retired recently and a new instrument, HIT-II, has just been installed at the position. A high-resolution powder diffractometer, HRP, is also one of the most productive instrument although this is a prototype one for instrumental development. A new instrument, HRP-II, is under construction, which will be installed at the experimental hall by September 1993. Developing research for new techniques also progressed. One highlight was the development of a ^{3}He polarizer. A polarization of about 50 % has already been attained. By increasing the laser power a higher polarization, hopefully more than 80 %, will be achieved in near future. (author).

33600 (KEK-PROC–92-4, pp. 380-389) **Hydrogen depth profile of Al-alloy vacuum chamber exposed to synchrotron radiation.** Kanazawa, K. (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)); Yanokura, M.; Aratani, M.; Akiyama, H. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). May 1992. (CONF-9203224–: 8. meeting on ultra high vacuum techniques for accelerators and storage rings, Tsukuba (Japan), 12-13 Mar 1992). In *Proceedings of the 8th meeting on ultra high vacuum techniques for accelerators and storage rings.* 464p. Order Number DE93764168. Source: OSTI; NTIS; INIS.

Hydrogen depth profile was measured for an Al-alloy vacuum chamber of the TRISTAN accumulation ring, which had been exposed to synchrotron radiation over 6 years. By analyzing the energy of hydrogen atoms elastically recoiled by 52.28 MeV argon beam, a dense hydrogen concentration near the surface is observed. The most dense part of the observed hydrogen is considered to correspond to a surface oxide layer of aluminium. The surface irradiated directly with synchrotron radiation shows the least hydrogen content which is about 1/10 of an un-irradiated surface. This observation gives a direct evidence for the assumption that for an aluminium chamber, hydrogen desorbed during exposure to synchrotron radiation has its origin in a surface oxide layer. (author).

33601 (LA-UR–93-2450) **Circuit modeling and component trimming to achieve performance requirements for the DARHT prototype injector.** Melton, J.G. Los Alamos National Lab., NM (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930616–16: 9. IEEE pulsed power conference, Albuquerque, NM (United States), 21-23 Jun 1993). Order Number DE93018353. Source: OSTI; NTIS; INIS; GPO Dep.

To produce an acceptable electron beam, the Dual-Axis Radiographic Hydrodynamic Test (DARHT) Facility accelerators require high-voltage pulses that are flat to within ±1% for 65±ns. Achieving this accuracy and pulse duration in operation on the Integrated Test Stand (a full-scale prototype of the DARHT 4-Mev injector and first eight linear induction accelerator cells) has required fine-tuning selected components in the injector pulsed power circuits. Several circuit analysis codes are used to analyze circuit performance and to predict the effects of component changes. Four cases are presented. (1) The center conductor of an ethylene glycol transmission line was tapered to compensate for a 4-5% tilt of the flat-top portion of the injector voltage waveform. (2) The mixture of water-glycol solution used in the Blumlein "peaking" section was changed to compensate for a 2% hump in the flat-top portion of the voltage waveform. (3) Confirmation was provided that observed changes in pulse shape could be caused by changes in dielectric constant of the ethylene glycol used in the Blumlein, caused by hygroscopic absorption of water vapor. (4) A damping resistor was added in series with the Blumlein center conductor to reduce the amplitude of low-frequency, post-pulse oscillations that were causing late-time flash-overs of the vacuum insulator.

33602 (LA-UR–93-2675) **Investigations of the electrical breakdown properties of insulator materials used in high voltage vacuum diodes.** Shurter, R.P.; Carlson, R.L.; Melton, J.G. Los Alamos National Lab., NM (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930616–17: 9. IEEE pulsed power conference, Albuquerque, NM (United States), 21-23 Jun 1993). Order Number DE93018461. Source: OSTI; NTIS; GPO Dep.

The Injector for the proposed Dual-Axis Radiographic Hydrodynamic Testing (DARHT) Facility at Los Alamos utilizes a monolithic insulator deployed in a radial configuration. The 1.83-m-diam × 25.4-cm-thick insulator with embedded grading rings separates the output oil transmission line from the vacuum vessel that contains the re-entrant anode and cathode assemblies. Although much work has been done by the pulse power community in studying surface flash-over of insulating materials used in both axial and radial configurations, dendrite growth at the roots of grading rings embedded in materials suitable for very large insulators is less well characterized. Degradation of several acrylic insulators has been observed in the form of dendrites growing at the roots of the grading rings for large numbers (100's) of pulses on the prototype DARHT Injector and other machines using similar radial geometries. In a few cases, these dendrites have led to catastrophic bulk breakdown of the acrylic between two grading rings making the insulator a costly loss. Insulating materials under investigation are acrylic (Lucite), epoxy (Furane), and cross-linked polystyrene (Rexolite); each of these materials has its own particular mechanical and electrical merits. All of these materials have been cast and machined into the required large size for the Injector. Test methods and the results of investigations into the breakdown strength of various interface geometries and the susceptibility of these materials to dendrite growth are reported.

33603 (LBL–33190) **The Phase Servo Tuner Control system of the ALS 500 MHz cavity.** Lo, C.C.; Taylor, B. Lawrence Berkeley Lab., CA (United States). May 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-930511–344: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993; LSGN–105). Order Number DE93018713. Source: OSTI; NTIS; INIS; GPO Dep.

Three 500 MHz cavities are used in the Booster and Storage Ring of the Advanced Light Source (ALS). Due to different varying parameters, a control system is required to keep the cavities in tune during operation. The tuning of the 500 MHz cavity is achieved by detecting the phase error between the drive signal

and the cavity probe signal. The error signal is amplified and used to drive a stepping motor which in turn moves a metallic cylinder in or out of the cavity to achieve tuning.

33604 (LBL–33197) **First undulators for the Advanced Light Source.** Hoyer, E.; Akre, J.; Chin, J. Lawrence Berkeley Lab., CA (United States). May 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-930511–343: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993; LSGN–103). Order Number DE93018700. Source: OSTI; NTIS; INIS; GPO Dep.

The first three undulators, each 4.6 m in length, for the Advanced Light source (ALS) at Lawrence Berkeley Laboratory (LBL), are near completion and are undergoing qualification tests before installation into the storage ring. Two devices have 5.0-cm period lengths, 89 periods, and achieve an effective field of 0.85 T at the 14 mm minimum magnetic gap. The other device has a period length of 8.0 cm, 55 periods, and an effective field of 1.2 T at the minimum 14 mm gap. Measurements on the first 5 cm period device show the uncorrelated field errors to be 0.23%, which is less than the required 0.25%. Measurements of gap control show reproducibility of ±5 microns or better. The first vacuum chamber, 5.0 m long, is flat to within 0.53 mm over the 4.6 m magnetic structure section and a 4×10^{-11} Torr pressure was achieved during vacuum tests. Device description, fabrication, and measurements are presented.

33605 (LBL–33221) **Final analysis of the ALS lattice magnet data.** Keller, R. Lawrence Berkeley Lab., CA (United States). May 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-930511–331: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018705. Source: OSTI; NTIS; INIS; GPO Dep.

A preliminary analysis of the measured magnet data of the multipole magnets to be installed in the Advanced Light Source (ALS) storage ring had been given in the last conference of this series. That analysis was based on measurements of about one-third of the entire magnet complement, and some of its findings had to be revised after obtaining more data. The present paper gives an account of the integrated fundamental field strengths of all installed storage ring lattice magnets. For the multipole magnets, these values are listed as analytical expressions with four or five parameters, that cover the entire excitation range and include residual strength. Based on this final analysis, all gradient and quadrupole magnets were qualified for installation, whereas the sextupole magnets had to be individually trimmed to bring their effective fundamental strengths into the desired tolerance band.

33606 (LBL–33224) **Flux shunts for undulators.** Hoyer, E. (Lawrence Berkeley Lab., CA (United States)); Chin, J.; Hassenzahl, W.V. Lawrence Berkeley Lab., CA (United States); Lawrence Livermore National Lab., CA (United States). May 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-930511–325: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018535. Source: OSTI; NTIS; INIS; GPO Dep.

Undulators for high-performance applications in synchrotron-radiation sources and periodic magnetic structures for free-electron lasers have stringent requirements on the curvature of the electron's average trajectory. Undulators using the permanent magnet hybrid configuration often have fields in their central region that produce a curved trajectory caused by local, ambient magnetic fields such as those of the earth. The 4.6 m long Advanced Light Source (ALS) undulators use flux shunts to reduce this effect. These flux shunts are magnetic linkages of very high permeability material connecting the two steel beams that support the magnetic structures. The shunts reduce the scalar potential difference between the supporting beams and carry substantial flux that would normally appear in the undulator gap. Magnetic design, mechanical configuration of the flux shunts and magnetic measurements of their effect on the ALS undulators are described.

33607 (LBL–33254) **Magnet costs for the Advanced Light Source.** Tanabe, J.; Krupnick, J.; Hoyer, E.; Paterson, A. Lawrence Berkeley Lab., CA (United States). May 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-930511–352: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018709. Source: OSTI; NTIS; INIS; GPO Dep.

The Advanced Light Source (ALS) accelerator is now completed. The numerous conventional magnets required for the booster ring, the storage ring and the low and high energy transfer lines were installed during the last two years. This paper summarizes the various costs associated with the quantity fabrication of selected magnet families. These costs include the costs of prototypes, tooling, coil and core fabrication, assembly and magnetic measurements. Brief descriptions of the magnets and specialized requirements for magnetic measurements are included in order to associate the costs with the relative complexities of the various magnet systems.

33608 (LBL–33283) **K^+ ion source for the heavy ion induction Linac System Experiment ILSE.** Eylon, S.; Henestroza, E.; Chupp, W.W.; Yu, S. Lawrence Berkeley Lab., CA (United States). May 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (HIFAN–568;CONF-930511–348: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018536. Source: OSTI; NTIS; INIS; GPO Dep.

Low emittance singly charged potassium thermionic ion sources are being developed for the ILSE injector. The ILSE, now under study at LBL, will address the physics issues of particle beams in a heavy ion fusion driver scenario. The K^+ ion beam is emitted thermionically into a diode gap from alumina-silicate layers (zeolite) coated uniformly on a porous tungsten cup. The Injector diode design requires a large diameter (4in. to 7in.) source able to deliver high current (~800 mA) low emittance ($E_n < .5\ \pi$ mm-mr) beam. The SBTE (Single Beam Test Experiment) 120 keV gun was redesigned and modified with the aid of diode optics calculations using the EGUN code to enable the extraction of high currents of about 90 mA out of a one-inch diameter source. We report on the 1in. source fabrication technique and performance, including total current and current density profile measurements using Faraday cups, emittance and phase space profile measurements using the double slit scanning technique, and life time measurements. Furthermore, we shall report on the extension of the fabricating technique to large diameter sources (up to 7in.), measured ion emission performance, measured surface temperature uniform heating power considerations for large sources.

33609 (LBL–33290) **The Advanced Light Source (ALS) Radiation Safety System.** Ritchie, A.; Oldfather, D.; Lindner, A. Lawrence Berkeley Lab., CA (United States). May 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-930511–353: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018708. Source: OSTI; NTIS; INIS; GPO Dep.

The Advanced Light Source (ALS) at the Lawrence Berkeley Laboratory (LBL) is a 1.5 GeV synchrotron light source facility consisting of a 120 keV electron gun, 50 MeV linear accelerator, 1.5 Gev booster synchrotron, 200 meter circumference electron storage ring, and many photon beamline transport systems for research. The Radiation Safety System for the ALS has been designed and built with a primary goal of providing protection against inadvertent personnel exposure to gamma and neutron radiation and, secondarily, to enhance the electrical safety of select magnet power supplies.

33610 (LBL–33291) **The ALS Storage Ring RF System.** Taylor, B.; Lo, C.C.; Baptiste, K.; Guigli, J.; Julian, J. Lawrence Berkeley Lab., CA (United States). May 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-930511–324: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018534. Source: OSTI; NTIS; INIS; GPO Dep.

The ALS Storage Ring RF System is characterized by the use of the following features: (1) High power loading of two single cell cavities. (2) The use of a tubular ceramic input window employing aperture coupling. (3) The use of waveguide filters and matchers

designed for HOM absorption. (4) A comprehensive HOM monitoring system. (5) The use of waveguide water-wedge loads for the magic tee and circulator loads. The results of cavity measurements and high power tests are reported together with the performance of the system during the commissioning and operation phases of the ALS project. Plans for future window development are discussed.

33611 (LBL–33292) **Performance of Advanced Light Source particle beam diagnostics.** Hinkson, J. Lawrence Berkeley Lab., CA (United States). May 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-930511–342: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993; LSGN–123). Order Number DE93018699. Source: OSTI; NTIS; INIS; GPO Dep.

The Advanced Light Source (ALS), a third-generation synchrotron radiation facility, is complete. The particle beam diagnostics have been installed and tested. The beam injection systems have been running for two years. We have performance data on beam position monitors, beam intensity monitors, scintillators, beam collimators, a 50 Ω Faraday cup, and broad-band striplines and kickers used in the linac, transport lines, and the booster synchrotron. The single-turn monitoring capability of the booster beam position monitoring system has been particularly useful for studying beam dynamics. Beam diagnostics for the storage ring are being commissioned. In this paper we describe each instrument, show its performance, and outline how the instruments are controlled and their output data displayed.

33612 (LBL–33294) **Magnet power supply system for the ALS storage ring and booster.** Jackson, L.T.; Luchini, K.; Lutz, I. Lawrence Berkeley Lab., CA (United States). May 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-930511–338: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993; LSGN–128). Order Number DE93018702. Source: OSTI; NTIS; INIS; GPO Dep.

The Magnet Power Supply System is described by specification, design, hardware, and operating experience. A unique system for the one Hz, 1.5 GeV Booster, where the wideband QF and QD power supplies track the dipole current to within 0.1% at injection will be detailed. AC distribution system considerations related to inverting the stored energy of the booster magnet back into power grid will be discussed. The rational for linear correctors and individual quad supplies (225 total units) will be placed within the context of the storage-ring requirements.

33613 (LBL–33315) **ILSE-ESQ injector scaled experiment.** Henestroza, E. (Lawrence Berkeley Lab., CA (United States)); Eylon, S.; Yu, S.; Grote, D. Lawrence Berkeley Lab., CA (United States); Lawrence Livermore National Lab., CA (United States). May 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (HIFAN–575;CONF-930511–355: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018707. Source: OSTI; NTIS; INIS; GPO Dep.

A 2 MeV, 800 mA, K^+ injector for the Heavy Ion Fusion Induction Linac Systems Experiments (ISLE) is under development at LBL. It consists of a 500 keV-1MeV diode preinjector followed by an electrostatic quadrupole accelerator (ESQ). One of the key issues for the ESQ centers around the control of beam aberrations due to the "energy effect": in a strong electrostatic quadrupole field, ions at beam edge will have energies very different from those on the axis. The resulting kinematic distortions lead to S-shaped phase spaces, which, if uncorrected, will lead eventually to emittance growth. These beam aberrations can be minimized by increasing the injection energy and/or strengthening the beam focusing. It may also be possible to compensate for the "energy effect" by proper shaping of the quadrupoles electrodes. In order to check the physics of the "energy effect" of the ESQ design a scaled experiment has been designed that will accommodate the parameters of the source, as well as the voltage limitations, of the Single Beam Transport Experiment (SBTE). Since the 500 keV pre-injector delivers a 4 cm converging beam, a quarter-scale experiment will fit the 1 cm converging beam of the SBTE source. Also, a 10 mA beam in SBTE, and the requirement of equal perveance in both systems, forces all the voltages to scale down by a factor 0.054. Results from this experiment and corresponding 3D PIC simulations will be presented.

33614 (ORNL/FTR–4203) **Travel to France to obtain operating experience with the CAPRICE ECR ion source: Foreign trip report, February 14–26, 1992.** Meyer, F.W. Oak Ridge National Lab., TN (United States). 19 Mar 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93014400. Source: OSTI; NTIS (US Sales Only); GPO Dep.

During a one-week's stay with the PSI group headed by G. Melin at Centre d'Etudes Nucleaires-Grenoble, the traveler obtained operating experience with the CAPRICE ECR ion source; source performances for He, N, Ar, and Ta ions were measured and all found to meet or exceed the specifications defined in the ORNL purchase order for this source. During testing of the source, some weaknesses in the mechanical design of the source were identified, whose effect will be closely monitored once the source becomes operational at ORNL. After his stay at CEN-G, the traveler visited GANIL in Caen, France, to learn about recent ECR source developments there, in particular the ECR4 ion source, which is a modification of the Grenoble CAPRICE source. While having roughly the same performance as the CAPRICE source, the mechanical design has been significantly improved. However, earliest delivery time for an ECR4 source is about 18 months, due to prior commitments, compared to immediate delivery for the CAPRICE source. During the past year, a very compact, completely permanent magnet-based ECR source, called NANOGAN, has been developed at GANIL in connection with a proposed radioactive beams development program. This source has recently become operational, and has shown rather attractive performances; because of its very low power requirements, it will undoubtedly find application in many diverse settings.

33615 (PNL-SA–21926) **ACQUIRE: A data acquisition system for CAMAC on SUN workstation.** Kouzes, R.T.; Lowry, M.M. Pacific Northwest Lab., Richland, WA (United States). Jun 1993. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930640–2: 8. IEEE conference on real-time computer applications in nuclear, particle and plasma physics, Vancouver (Canada), 8-11 Jun 1993). Order Number DE93017663. Source: OSTI; NTIS; INIS; GPO Dep.

The data acquisition software package ACQUIRE been used for many years by the Princeton University Cyclotron Laboratory for nuclear physics research applications. This code has been ported to the SUN Sparc workstation and is fully functional, including block data transfers using an in crate Event Handler. A SCSI interface to CAMAC is utilized, and the device handling software has been developed in such a way that little modification was needed in the ACQUIRE code for the SUN implementation. The Higz X windows graphics package from CERN is used for data display.

33616 (SSCL-Preprint–247) **Preliminary results from a study of collar lamination variation in SSC Prototype Dipole Magnets.** Gattu, R.; Brown, G.M.; Pollock, D. Superconducting Super Collider Lab., Dallas, TX (United States). Apr 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930537–37: 5. annual international industrial symposium on the Super Collider and exhibition, San Francisco, CA (United States), 6-8 May 1993). Order Number DE93014170. Source: OSTI; NTIS; INIS; GPO Dep.

The collar laminations used in SSC Prototype Collider Dipole Magnets determine the volume within which the magnet coils are constrained after collaring and keying. The uniformity and symmetry of the inside volume of the collars along the length of the magnet may have a significant influence on the field quality of the finished assembly. This paper describes an on-going Statistical Quality Control study of collar lamination dimensional variation being performed by SSCL Magnet Systems Division Quality Assurance. Samples of collars have been measured using a coordinate measuring machine evaluate manufacturing process capability as well as the overall uniformity of the inventory population of collar laminations. The collar data will be used to predict variation in the coil assembly center and radius for inner and outer top-bottom, left-right coil combinations well as pole angles. Collar results will

be combined with azimuthal coil size measurements part of a manufacturing cause and effect model for predicting axial geometric multipoles based on the observed mechanical variation. This work focuses on Prototype Collider Dipole Magnet DCA 102 currently being built at the SSCL MDL in Waxahachie, Texas. This magnet is being made on the same coil curing and collaring mold cavities that were used for the DCA 300 series magnets built at FNAL in 1991–1992 and which were later used in the 1992 Accelerator Systems String Test (ASST). The collars are part of the same procurement used for the DCA300 series magnets.

33617 (SSCL-Preprint–283) **Multilayer insulation for the interconnect region in the Accelerator System String Test: A practical engineering approach for a new scheme of design and installation bridges.** Baritchi, D.; Jalloh, A. Superconducting Super Collider Lab., Dallas, TX (United States). Apr 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930537–95: 5. annual international industrial symposium on the Super Collider and exhibition, San Francisco, CA (United States), 6-8 May 1993). Order Number DE93018748. Source: OSTI; NTIS; INIS; GPO Dep.

In order to minimize the heat leak in the Accelerator System String Test (ASST) inter-connect region, shield bridges and multilayer insulation (MLI) are provided. A sliding joint between shield bridges on adjacent magnets accommodates the contraction that occurs during cooldown. In the original design of the MLI bridges, thermal contraction was provided for by compressing the MLI. During assembly of the interconnect region, it was realized that there was not enough room for the required compression. This resulted in a redesign of the MLI bridges. The new scheme involves splitting and overlapping the MLI. This scheme has worked very well in subsequent assembly of the interconnect region. In this paper, we are going to present the new design scheme. We will also compare this design with the original design and present its advantages.

33618 (SSCL-Preprint–303) **A study of the effect of cable insulation on coil properties.** Spindel, A.; Sims, R.; Bastian, S.; Pollock, D. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930537–89: 5. annual international industrial symposium on the Super Collider and exhibition, San Francisco, CA (United States), 6-8 May 1993). Order Number DE93018009. Source: OSTI; NTIS; INIS; GPO Dep.

Stacks of insulated superconducting cable were cured and tested for mechanical properties. Four different polyimide films were investigated in all polyimide insulation schemes. The effect of bottom layer material, top layer material and wrapping scheme on stack size, modulus, and compressive creep are reported.

33619 (SSCL-Preprint–307) **A methodology to describe process control requirements.** Carcagno, R.; Ganni, V. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930537–93: 5. annual international industrial symposium on the Super Collider and exhibition, San Francisco, CA (United States), 6-8 May 1993). Order Number DE93018006. Source: OSTI; NTIS; GPO Dep.

This paper presents a methodology to describe process control requirements for helium refrigeration plants. The SSC requires a greater level of automation for its refrigeration plants than is common in the cryogenics industry, and traditional methods (e.g., written descriptions) used to describe process control requirements are not sufficient. The methodology presented in this paper employs tabular and graphic representations in addition to written descriptions. The resulting document constitutents a tool for efficient communication among the different people involved in the design, development, operation, and maintenance of the control system. The methodology is not limited to helium refrigeration plants, and can be applied with similar requirements. The paper includes examples.

33620 (SSCL-Preprint–316) **Summary of dipole field angle measurements on 50mm-aperture SSC Collider Dipole Magnet Protoypes.** Marks, J. (Superconducting Super Collider Lab., Dallas, TX (United States)); DiMarco, J.; Kuzminski, J.; Ogitsu, T.; Zheng, H.; Bleadon, M.; Kuchnir, M.; Schmidt, E.E.; Yu, Y. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930537–80: 5. annual international industrial symposium on the Super Collider and exhibition, San Francisco, CA (United States), 6-8 May 1993). Order Number DE93016887. Source: OSTI; NTIS; INIS; GPO Dep.

At several stages in the production of the SSC collider dipole magnets and their final installation the magnetic field angle needs to be known. A simple device using a permanent magnet which aligns itself with the magnetic field had been developed at FNAL to survey the direction of the magnetic dipole field with respect to the vertical (as determined by gravity) along the magnet axis. The determination of the dipole field angle was part of the field quality characterization of a series of thirteen full-length 50mm-aperture SSC Collider Dipole Magnet Prototypes which were built for R&D purposes at FNAL. Measurements with the first developed FAP system were performed on a regular basis through several stages of the magnet production process with the intention of fabrication quality control. Part of these included measurements performed before and after cryogenic testing: these data are summarized here. The performance of a second system with an improved probe and data acquisition system was tested on part of the DCA series as well. This paper includes a presentation of time stability, noise and angular resolution data of this second probe. Another alternative instrument to determine the dipole field angle is the "mole" rotating coil system developed at BNL used mainly to measure the multipole components of the magnetic field. In the case of magnet DCA320, a comparison is made between the field angle as determined by the mole and those determined by both of the FAPS.

33621 (SSCL-Preprint–317) **Mechanical analysis of the DSB cross-section.** Chen, Yanping. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930537–86: 5. annual international industrial symposium on the Super Collider and exhibition, San Francisco, CA (United States), 6-8 May 1993). Order Number DE93016892. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents the preliminary mechanical finite element analysis for the SSCL designed DSB dipole magnet. This SSCL version 50 mm aperture dipole magnet is for the SSCL High Energy Booster with nineteen turns, three wedges for inner coil and twenty six turns, one wedge for outer coil, the round collar is nineteen mm thick, the yoke and the shell are adopted from the design for quadrupole QSEIO1. The main purposes of this mechanical study are to ensure that there are no excessive stresses in the cold mass under different loading, to avoid coils unloading from the collar at excitation of 6500 A, to ensure collar-to-yoke, line-to-line fit after welding the shell, and also to ensure the yoke midplane gaps are closed at an operating current of 6500 A. Therefore, the analyses performed include magnet assembly (collaring) to 69 Mpa azimuthal stress at the inner coil pole and 55 Mpa azimuthal stress at the outer coil pole; shell welding to 207 Mpa azimuthal stress in the shell; magnet cooldown to 4.25 K; and Lorentz excitation at a current of 6500 A.

33622 (SSCL-Preprint–335) **Engineered design of SSC cooling ponds.** Bear, J.B. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930537–104: 5. annual international industrial symposium on the Super Collider and exhibition, San Francisco, CA (United States), 6-8 May 1993). Order Number DE93019824. Source: OSTI; NTIS; INIS; GPO Dep.

The cooling requirements of the SSC are significant and adequate cooling water systems to meet these requirements are critical to the project's successful operation. The use of adequately designed cooling ponds will provide reliable cooling for operation while also meeting environmental goals of the project to maintain streamflow and flood peaks to preconstruction levels as well as other streamflow and water quality requirements of the Texas Water Commission and the Environmental Protection Agency.

33623 (SSCL-Preprint–336) **Design of a tunnel cooling system.** Cheng, A. (D'Escoto Associates, Dallas, TX (United States));

Dawson, R.; Zhao, R. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930537–90: 5. annual international industrial symposium on the Super Collider and exhibition, San Francisco, CA (United States), 6-8 May 1993). Order Number DE93018007. Source: OSTI; NTIS; INIS; GPO Dep.

Based on a thermal analysis of the SSC main tunnel and requirements for space conditions in the underground electronics niches, thermal cooling systems will be required to reject the heat dissipated underground. Many system were considered and compared to decide the optimum solution. Construction documents are being prepared and contract administration will proceed as technical and non-technical objectives are pursued.

33624 (SSCL-Preprint–387) **Lamination and end pack design studies of SSC low energy booster magnet prototypes.** Li, N. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930511–67: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93014101. Source: OSTI; NTIS; INIS; GPO Dep.

The SSC Laboratory plans to deploy two "large" detectors for the essential high-energy physics experiments at the initial startup of the collider. The GEM detector is optimized to emphasize precise measurement of photons and electrons, as well as precise tracking of high-energy muons. An essential part of the GEM detector is the magnet subsystem, which provides the magnetic field necessary for identification and high-resolution tracking of charged particles. This large superconducting magnet system, with ferromagnetic field-shapers, presents a variety of engineering challenges in superconductor technology, in magnet-winding technology, fabrication, assembly and installation of large and heavy components, and in ensuring the required high operating availability.

33625 (SSCL-Preprint–419) **2 TeV HEB beam abort at the SSCL.** Schailey, R.; Bull, J.; Clayton, T.; Kocur, P.; Mokhov, N. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930511–318: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018011. Source: OSTI; NTIS; INIS; GPO Dep.

The High Energy Booster (HEB) of the Superconducting Super Collider Laboratory (SSCL) will require a full aperture beam abort over a dynamic energy range of 200 GeV to 2 TeV. Since the HEB is a bi-polar machine, both clockwise (CW) and the counter-clockwise (CCW) beam aborts are required. Also, the stored beam energy of 6.55 MJ in the superconducting HEB imposes upon the full aperture requirement. In this report, we describe the abort channels in the HEB utility straight sections, aperture restrictions, mechanical interferences and solutions, kicker misfires, and a 1 TeV beam absorber.

33626 (SSCL-Preprint–449) **A liquid helium cryogenic system design for the GEM magnet.** Deis, G. (Lawrence Livermore National Lab., CA (United States)); Warren, R.P.; Richied, D.E.; Martovetsky, N.N.; Krupczak, J.J.; Sidi-Yekhlef, A.; Pace, J.R.; Collins, C.A. Superconducting Super Collider Lab., Dallas, TX (United States). Jun 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486 ;W-7405-ENG-48. (UCRL-JC–114580;CONF-930703–11: International cryogenic engineering conference and international cryogenic materials conference, Albuquerque, NM (United States), 12-16 Jul 1993). Order Number DE93018004. Source: OSTI; NTIS; INIS; GPO Dep.

The Superconducting Super Collider (SSC) Gammas, Electrons, Muons (GEM) magnet is a large superconducting solenoid with a total mass of 1.05×10^6 kg and a stored energy of 2.5 G. A cryogenic system to cool and to maintain the GEM magnet to liquid helium temperature is described. The system is designed to operate effectively under a variety of operating conditions, including cooldown/warm-up, steady state operations, and quench. Primary cooling during steady-state operation is based on natural circulation thermosiphon flow through cooling tubes in the solenoid support bobbin. Additional cooling loops are included for lead and joint cooling and conductor stabilization. A helium refrigerator/liquefier rated at 2 kill and 20 g/s will be specified to meet the refrigeration requirements. Cooldown of the magnet from 300 K to liquid nitrogen temperatures is accomplished using a counterflow helium-to-liquid-nitrogen heat exchanger independent of the helium refrigerator. The system incorporates provisions for maintenance access during accelerator beam operation.

33627 (SSCL-Preprint–475) **Cold test facility for 1.8 m superconducting model magnets at the SSC.** LaBarge, A. Superconducting Super Collider Lab., Dallas, TX (United States). Jul 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930703–16: International cryogenic engineering conference and international cryogenic materials conference, Albuquerque, NM (United States), 12-16 Jul 1993). Order Number DE93018759. Source: OSTI; NTIS; INIS; GPO Dep.

A new facility has been constructed to measure the characteristic features of superconducting model magnets and cable at cryogenic temperatures – a function which supports the design and development process for building full-scale accelerator magnets. There are multiple systems operating in concert to test the model magnets, namely: cryogenic, magnet power, data acquisition and system control. A typical model magnet test includes the following items: (1) warm measurements of magnet coils, strain gauges and voltage taps; (2) hipot testing of insulation integrity; (3) cooling with liquid nitrogen and then liquid helium; (4) measuring quench current and magnetic field; (5) magnet warm-up. While the magnet is being cooled to 4.22 K, the mechanical stress is monitored through strain gauges. Current is then ramped into the magnet until it reaches some maximum value and the magnet transitions from the superconducting state to the normal state. Normal-zone propagation is monitored using voltage taps on the magnet coils during this process, thus indicating where the transition began. The current ramp is usually repeated until a plateau current is reached, where the magnet has mechanically settled.

33628 (SSCL-Preprint–478) **Data Acquisition for detector prototypes at the SSCL.** Botlo, M.; Jagielski, M.; Miller, L.; Romero, A. Superconducting Super Collider Lab., Dallas, TX (United States). Jun 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930640–3: 8. IEEE conference on real-time computer applications in nuclear, particle and plasma physics, Vancouver (Canada), 8-11 Jun 1993). Order Number DE93018012. Source: OSTI; NTIS; INIS; GPO Dep.

We report on the design and implementation of a Data Acquisition System for experimental setups within the Physics Research Division of the Superconducting Super Collider. The design of the system is driven by the requirements of flexibility, modularity, portability, and safety. We emphasize off the shelf hard- and software such as Motorola 68040 and RISC based processors, standard data links, and accepted packages such as X-windows and the real-time operating system VxWorks. We discuss both the quantitative and qualitative performance of our system and conclude with a brief review of current research and development in areas such as slow controls and Data-Machine Independence.

33629 (SSCL-Preprint–487) **An engineering design study of alternative design options for the forward toroids of the SSC SDC detector.** Dittert, L. (ICF Kaiser Engineers, Inc., Oakland, CA (United States)); Western, J. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. (CONF-930537–102: 5. annual international industrial symposium on the Super Collider and exhibition, San Francisco, CA (United States), 6-8 May 1993). Order Number DE93019741. Source: OSTI; NTIS; INIS; GPO Dep.

The Muon Forward Toroids (MFTs) are 3-meter-thick sections of magnetized iron located at both ends of the detector proposed by the Solenodial Detector Collaboration (SDC). The forward calorimeter and the outer muon chamber layers are supported by the MFT. This paper investigates viable and cost effective construction alternatives for the MFTs.

33630 (SSCL-SR–1223) **Radiation environment and shielding for the GEM experiment at the SSC.** Diwan, M.; Fisyak, Y.; Mokhov, N. Superconducting Super Collider Lab., Dallas, TX (United States). Jul 1993. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE93018650. Source: OSTI; NTIS; INIS; GPO Dep.

We have performed a comprehensive study of the radiation environment for the proposed GEM detector at the SSC. As a result of this study, we have developed a shielding scenario that will ensure that the detector will operate with its design performance for at least 10 years at the luminosity of 10^{33} $cm^{-2}s^{-1}$.

33631 (UCRL-JC–112224) **Optimum current densities from high current H^- and D^- sources.** Hiskes, J.R. Lawrence Livermore National Lab., CA (United States). 4 Nov 1992. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-921145–9: Production and neutralization of negative ions and beams, Upton, NY (United States), 9-13 Nov 1992). Order Number DE93018070. Source: OSTI; NTIS; INIS; GPO Dep.

The tandem system, with the electron energy distribution arranged spatially and with electron energies decreasing toward the exit aperture, will generate a five-fold enhancement in extracted current density when compared to an optimal single-chamber system. With the increased understanding of the underlying atomic processes, together with a body of experience in the operation high-power hydrogen and deuterium discharges, it has now become possible to specify in absolute terms the optimal current-density performance of a hydrogen/deuterium system. A variation on the single-chamber and tandem systems has been purposed that employs a single-chamber, pulsed discharge. Following the discharge pulse, the transient variation of the electron energy distribution allows for a more optimal generation of negative ions than does the static single-chamber system. Some of the limitations of this system when compared with the steady-state tandem system are discussed here.

33632 (UCRL-JC–112245) **PIC space-charge emission with finite Δt and Δz.** Hewett, D.W.; Chen, Yu-Jiuan. Lawrence Livermore National Lab., CA (United States). 22 Feb 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930269–16: Computational accelerator physics conference (CAP93), Pleasanton, CA (United States), 22-26 Feb 1993). Order Number DE93018103. Source: OSTI; NTIS; INIS; GPO Dep.

A new algorithm for space charge emission has been developed to provide the correct (to a few percent) Child-Langmuir steady-state current limits as the number of mesh points in the voltage gap drops to O(10). Further, the transient behavior of such flows compares well with idealized, analytic cases, lending confidence as we extend these algorithms into full RZ geometry with curved emitting surfaces to investigate transient characteristics of realistic injector designs.

33633 (UCRL-JC–114625) **Optimum extracted H^- and D^- current densities from gas-pressure-limited high-power hydrogen/deuterium tandem ion sources.** Hiskes, J.R. Lawrence Livermore National Lab., CA (United States). 14 Jul 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9308136–1: 5. international conference on ion sources, Peking (China), 31 Aug - 4 sep 1993). Order Number DE93018090. Source: OSTI; NTIS; INIS; GPO Dep.

The tandem hydrogen/deuterium ion source is modelled for the purpose of identifying the maximum current densities that can be extracted subject to the gas-pressure constraints proposed for contemporary beam-line systems. Optimum useful extracted current densities are found to be in the range of approximately 7 to 10 mA cm^{-2}. The sensitivity of these current densities is examined subject to uncertainties in the underlying atomic/molecular rate processes; A principal uncertainty remains the quantification of the molecular vibrational distribution following H_{3+} wall collisions.

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Refer also to citation(s) 33522, 33524, 33561

33634 (ANL/ASD/CP–78366) **Circuit description of unipolar DC-to-DC converters for APS storage ring quadrupoles and sextupoles.** McGhee, D.G. Argonne National Lab., IL (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–306: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017743. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes the control, interlock, and power circuits for 680 unipolar switch mode DC-to-DC converters used to regulate the Advanced Photon Sources (APS's) storage ring quadrupole and sextupole magnet currents. Quadrupole current stability is $\pm 6\times10^{-5}$ and the sextupole current stability is $\pm3\times10^{-4}$. The stability is obtained with pulse width modulation, operating at a switching frequency of 20kHz with full current switching. The converters are housed in 200 cabinets located on top of the storage ring tunnel. Raw DC power is distributed from 80 AC-to-DC power supplies, four at each of 20 locations around the storage ring. Voltages, currents, and temperatures are computer monitored and logged for the converters and magnets. All converters and magnets are water cooled with the flow and pressure monitored at the inlet and outlet of groups. Water is interlocked with the raw power supplies and not the individual converters.

33635 (ANL/ASD/VU–78335) **HOM (higher-order mode) test of the storage ring single-cell cavity with a 20-MeV e^- beam for the Advanced Photon Source (APS).** Song, J.; Kang, Y.W.; Kustom, R. Argonne National Lab., IL (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930511–298: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017420. Source: OSTI; NTIS; INIS; GPO Dep.

To test the effectiveness of damping techniques of the APS storage ring single-cell cavity, a beamline has been designed and assembled to use the ANL Chemistry Division linac beam (20-MeV, FWHM of 20 ps). A single-cell cavity will be excited by the electron beam to investigate the effect on higher-order modes (HOMs) with and without coaxial dampers (H-loop damper, E-probe damper), and wideband aperture dampers. In order for the beam to propagate on- and off-center of the cavity, the beamline consists of two sections – a beam collimating section and a cavity measurement section – separated by two double Aluminum foil windows. RF cavity measurements were made with coupling loops and E-probes. The results are compared with both the TBCI calculations and 'cold' measurements with the bead-perturbation method. The data acquisition system and beam diagnostics will be described in a separate paper.

33636 (ANL/PHY/CP–80101) **Experiments with polarized deuterium target at VEPP-3 storage ring: Status and perspective.** Frolov, V.V. (AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki); Mishnev, S.I.; Nikolenko, D.M. Argonne National Lab., IL (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930544–3: Conference on polarized ion sources and polarized gas targets, Madison, WI (United States), 23-27 May 1993). Order Number DE93017449. Source: OSTI; NTIS; INIS; GPO Dep.

A status of the internal polarized deuterium target experiment at VEPP-3 storage ring at 2 GeV electron energy is presented. A value of T_{20} at q = 3.7fm $^{-1}$ was obtained by suing an active storage cell in conjunction with an atomic beam source. Substantial progress is expected by introducing the high-density laser-driven target.

33637 (BNL–49166) **Simulation of emittance dilution in electron storage ring from Compton backscattering.** Blumberg, L.N.; Blum, E. Brookhaven National Lab., Upton, NY (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-930511–302: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017611. Source: OSTI; NTIS; INIS; GPO Dep.

A Monte-Carlo simulation of Compton backscattered κ_L=3.2-μm photons from an IR-FEL on 75-MeV electrons in a storage ring

yields an RMS electron energy spread of Δ_E=11.9-keV for a sample of 10^7 single scattering events. Electrons are sampled from a beam of natural energy spread σ_E = 5.6-keV and damped transverse angle spreads σ_x', = .041-mrad and σ_y' = .052-mrad (100%) coupling, scaled from the 200-MeV BNL XLS compact storage ring. The Compton-scattered X-Rays are generated from an integral of the CM Klein-Nishina cross-section transformed to the lab. A tracking calculation has also been performed in 6-dimensional phase space. Initial electron coordinates are selected randomly from a Gaussian distribution of RMS spreads σ_{xo}=.102-mm, $\sigma_{x'o}$=.041-mrad, σ_{yo}=.018-mm, $\sigma_{y'o}$=.052-mrad, $\sigma_{\phi o}$=22-mrad and σ_{Eo}=6-keV. A sample of 10000 electrons were each following for 40000 turns around the ring through an RF cavity of f_{rf}=211.54-MHz and peak voltage V_m=300-keV. Preliminary results indicate that the resulting energy distribution is quite broad with an RMS width of Δ_E = 124-keV. The transverse widths are only slightly increased from their original values, i.e. Δ_x = .106-mm and $\Delta_{x'}$=.043 mrad. The scaled energy spread of $\Delta_E \sim$ 360-keV for $\sim$ 350,000 turns desired in a 10-msec X-Ray angiography exposure is well within the RF bucket used here; even V_m < 50-kV is adequate. Further, the electron energy spread adds a negligible RMS X-Ray energy spread of Δ_{Ex}=.32-keV. The electron energy damping time of τ_E=379-msec at 75-MeV in an XLS-type ring allows for damping this induced spread and top-off of the ring between heart cycles.

33638 (BNL–49167) **Plans to increase source brightness of NSLS x-ray ring.** Safranek, J.; Krinsky, S. Brookhaven National Lab., Upton, NY (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-930511–301: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017612. Source: OSTI; NTIS; INIS; GPO Dep.

We discuss plans to increase the NSLS X-Ray ring source brightness by an order of magnitude. Proposed improvements include doubling current from 250 mA to 500 mA, reducing vertical emittance by a factor of 6 and reducing insertion device gaps and periods by up to a factor of two. Experimental results are reported which indicate we have succeeded in reducing the vertical emittance below 2 Å.

33639 (FNAL/C–93/125) **Effects of transverse coupling on transverse beam size, simulation and measurements.** Halling, A.M. Fermi National Accelerator Lab., Batavia, IL (United States). May 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-930511–311: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017804. Source: OSTI; NTIS; INIS; GPO Dep.

The equations of motion for particles in an accelerator lattice show that a larger physical aperture is required to hold a beam of constant invariant emittance if there is transverse coupling of the tunes. The results of a tracking simulation of particle motion in the Fermilab accumulator ring are discussed, and results are shown from beam tests carried out in the accumulator to demonstrate this effect.

33640 (KEK-PR–92-1) **The tristan super light facility: Conceptual design report 1992.** National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Dec 1992. 223p. Order Number DE93520379. Source: OSTI; NTIS; INIS.

The Photon Factory and its user group have achieved excellent scientific results since its commissioning in 1982, ranging from material science to medical application, by using the synchrotron radiation at the 2.5 GeV PF storage ring, and since 1986, further at the 6.5 GeV Tristan accumulation ring which provides brilliant photons in high energy region. Efforts are exerted currently at National Laboratory for High Energy Physics for the extensive research and development works to study the feasibility of the Tristan e^+e^- collider main ring to be utilized as an extremely intense and highly advanced light source, which is called Tristan super light facility. What kinds of the application are expected for such highly brilliant source and their scientific significance should be clarified. This design report is an outcome by the joint work of in-house staffs and outside users, and it would serve as an excellent guide for the future studies on a next generation synchrotron radiation light source. The conversion plan of Tristan, the basic design of insertion devices, coherent X-ray sources, beam lines, instrumentation and others are reported. (K.I.).

33641 (KEK-PROC–92-4, pp. 6-8) **PLS vacuum chamber.** Choi, Woo-Chun (Pohang Inst. of Science and Technology, Kyuugnam (Korea, Republic of)); Park, Soo-Yong. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). May 1992. (CONF-9203224–: 8. meeting on ultra high vacuum techniques for accelerators and storage rings, Tsukuba (Japan), 12-13 Mar 1992). In *Proceedings of the 8th meeting on ultra high vacuum techniques for accelerators and storage rings.* 464p. Order Number DE93764168. Source: OSTI; NTIS; INIS.

The PLS vacuum chambers consist of 12 times of two sector chambers and one straight section. The chamber material is Al 5083-H321. Each chamber consists of a top and a bottom piece, which are machined separately and welded together. The pumping system to reduce the average operating pressure up to a nano Torr has three nine sets of lumped NEGs in tandem with ion pumps installed beneath photon stops, and six ion pumps per superperiod. Helicoflex seals are used to connect all vacuum components onto the vacuum chamber. A prototype chamber will be machined by February 1992. (author).

33642 (KEK-PROC–92-4, pp. 38-46) **The TRISTAN light source project.** Kamada, S. (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). May 1992. (CONF-9203224–: 8. meeting on ultra high vacuum techniques for accelerators and storage rings, Tsukuba (Japan), 12-13 Mar 1992). In *Proceedings of the 8th meeting on ultra high vacuum techniques for accelerators and storage rings.* 464p. Order Number DE93764168. Source: OSTI; NTIS; INIS.

The TRISTAN main ring will be converted into a synchrotron light source of ultra high brilliance. The beam parameters of the TRISTAN light source are presented with the discussion on the merits of high energy accelerators as light sources. Also presented are the lattice layout and the optics which are to incorporate super long undulators and emittance damping wigglers (EDW). The super long undulator is a key to ultra high brightness and the EDW is an important tuning knob of e^+ (or e^-) beam. The related accelerator physics issues, such as dynamic aperture, intra-beam scattering, orbit errors and multi-bunch instabilities, are introduced. (author).

33643 (LBL–33220) **Survey and alignment data analysis for the ALS storage ring.** Keller, R. Lawrence Berkeley Lab., CA (United States). May 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-930511–334: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018703. Source: OSTI; NTIS; INIS; GPO Dep.

The survey and alignment effort for the Advanced Light Source (ALS) accelerator complex has been described elsewhere. Data analysis for this task comprises the creation of ideal data, comparison of measured coordinates with ideal ones, and computation of alignment values, taking into account the effects caused by finite observation accuracy. A novel approach has been taken, using personal computer spreadsheets rather than more conventional programming methods. This approach was induced by the necessities to create and frequently refine the analysis procedures while measurements were already underway, and further by hardware constraints that limited the use of an available surveying code. A major benefit consists in the ability to identify and deal with discrepancies that occasionally arise when different techniques are used to observe the same object, in a timely and efficient manner. As a result of the performed survey and alignment work, the ALS lattice magnets have been positioned with accuracies well exceeding the original specifications.

33644 (LBL–33265) **Beam-beam effects for the PEP-II B Factory.** Furman, M.A. (Lawrence Berkeley Lab., CA (United States)); Eden, J.R. Lawrence Berkeley Lab., CA (United States); Washington Univ., Seattle, WA (United States). Dept. of Geophysics. May 1993. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-930511–339: International particle accelerator conference, Washington, DC

(United States), 17-20 May 1993). Order Number DE93018701. Source: OSTI; NTIS; INIS; GPO Dep.

We present a summary of a fairly extensive study of beam-beam issues that arise in the design of PEP-II. Most of these studies are carried out with "strong-strong" multiparticle tracking simulations. We focus on: choice of nominal beam-beam parameter, strength of the parasitic collisions, injection issues, performance and tradeoffs with unequal beam-beam parameters. We comment only briefly on beam lifetime. We conclude that: the beams are sufficiently well separated so that the parasitic collisions are effectively weak; that small inequalities in the beam-beam parameters may imply more comfortable performance margins; and that vertical injection with vertical beam separation is more comfortable than horizontal.

44 INSTRUMENTATION

Refer also to citation(s) 33014, 33383

33645 (PNL–8645) **Ultrawideband radar clutter measurements of forested terrain, 1991–1992.** Sheen, D.M.; Severtsen, R.H.; Prince, J.M.; Davis, K.C.; Collins, H.D. Pacific Northwest Lab., Richland, WA (United States). Jun 1993. 279p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93017970. Source: OSTI; NTIS; GPO Dep.

The ultrawideband (UWB) radar clutter measurements project was conducted to provide radar clutter data for new ultrawideband radar systems which are currently under development. A particular goal of this project is to determine if conventional narrow band clutter data may be extrapolated to the UWB case. This report documents measurements conducted in 1991 and additional measurements conducted in 1992. The original project consisted of clutter measurements of forested terrain in the Olympic National Forest near Sequim, WA. The impulse radar system used a 30 kW peak impulse source with a 2 Gigasample/second digitizer to form a UHF (300–1000 MHz) ultrawideband impulse radar system. Additional measurements were conducted in parallel using a Systems Planning Corporation (SPC) step-chirp radar system. This system utilized pulse widths of 1330 nanoseconds over a bandwidth of 300–1000 MHz to obtain similar resolution to the impulse system. Due to the slow digitizer data throughput in the impulse radar system, data collection rates were significantly higher using the step-chirp system. Additional forest clutter measurements were undertaken in 1992 to increase the amount of data available, and especially to increase the amount of data from the impulse radar system.

4401 Radiation Instrumentation

Refer also to citation(s) 32146, 32349, 32425, 32591, 32594, 32596, 32597, 32599, 33134, 33288, 33550, 33551, 33556, 33582, 33595, 33626, 33629, 33690, 33922, 34012, 34039, 34040, 34058, 34243, 34462

33646 (ANL/IPNS/CP–79156) **Linearity and calibration of charge-division and rise-time encoded gas PSDs.** Crawford, R.K. (Argonne National Lab., IL (United States)); Thiyagarajan, P.; Chen, J. Argonne National Lab., IL (United States); Massachusetts Inst. of Tech., Cambridge, MA (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9305177–11: 12. International collaboration of advanced neutron sources meeting (ICANS), Abingdon (United Kingdom), 24-28 May 1993). Order Number DE93017796. Source: OSTI; NTIS; GPO Dep.

Both linear and area gas proportional counter position-sensitive detectors (PSDs) are used at IPNS, and both charge-division and rise-time encoding schemes are used for these detectors. Impedance mismatching at the detector ends can lead to nonlinearities in the analog portion of the encoding circuits, and digitization errors can lead to local channel-to-channel variations in the position encoding. Some of these nonlinearities can be eliminated by appropriate circuit design, and a calibration scheme has been devised to effectively eliminate the remaining problems. Both circuit improvements and the calibration methods are discussed.

33647 (BHR–71) **Reactor physics models for neutron porosity gauges.** Oelgaard, P.L. Danmarks Tekniske Hoejskole, Lyngby (Denmark). Afd. for Elektrofysik. May 1993. 16p. Order Number DE94600289. Source: OSTI; NTIS; INIS.

In this paper investigations of the development of theoretical models for neutron porosity gauges or tools, used in borehole logging, is reported. The first gauge considered consisted of a Ra-Be neutron source and a BF_3 thermal neutron detector. The second gauge consisted of a ^{241}Am-Be neutron source and a ^{6}Li containing glass scintillator which detects both thermal and epithermal neutrons. The third gauge was a double detector (^{3}He counters) neutron porosity tool used by a commercial logging company. It too is provided with a ^{241}Am-Be neutron source. In all cases the theoretical models developed were compared with experimental data and reasonable agreement was obtained. (au).

33648 (BNL–49016) **Fabrication of large area Si cylindric drift detectors.** Chen, W. (Brookhaven National Lab., Upton, NY (United States)); Kraner, H.W.; Li, Z.; Rehak, P.; Hess, F. Brookhaven National Lab., Upton, NY (United States). Apr 1993. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-931107–1: Nuclear science symposium, San Francisco, CA (United States), 2-5 Nov 1993). Order Number DE93016132. Source: OSTI; NTIS; GPO Dep.

Advanced Si drift detector, a large area cylindrical drift detector (CDD), processing steps, with the exception of the ion implantation, were carried out in the BNL class 100 cleanroom. The double-side planer process technique was developed for the fabrication of CDD. Important improvements of the double-side planer process in this fabrication are the introduction of Al implantation protection mask and the remaining of a 1000 Angstroms oxide layer in the p-window during the implantation. Another important design of the CDD is the structure called "river," which ,allows the current generated on Si-SiO_2 interface to "flow" into the guard anode, and thus can minimize the leakage current at the signed anode. The test result showed that most of the signal anodes have the leakage current about 0.3 nA/cm^2 for the best detector.

33649 (BNL–49160) **Progress in the development of two-dimensional multiwire detectors for X-ray synchrotron radiation experiments.** Smith, G.C.; Yu, B.; Capel, M. Brookhaven National Lab., Upton, NY (United States). Jun 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-931107–4: Nuclear science symposium, San Francisco, CA (United States), 2-5 Nov 1993). Order Number DE93017590. Source: OSTI; NTIS; INIS; GPO Dep.

A report is presented of the developments in two-dimensional, multiwire detectors for X-ray synchrotron radiation experiments, using delay line position readout. Advances have been made in methods of cathode design and fabrication, a description is given of the trade-off between position resolution and count rate capability, and the importance of low dead-time TDCs is illustrated. A detector has been operating successfully for well over a year at the time resolved, scattering station of the National Synchrotron Light Source; results are presented from this which illustrate the very good resolution (100 μm FWHM), differential non-linearity ($\pm$4%) and absolute position stability of these devices, and the importance of low differential non-linearity for these types of experiment.

33650 (CONF-9209263–14) **Fast sampling calorimetry with solid argon ionization chambers.** Clark, E. (Florida State Univ., Tallahassee, FL (United States)); Linn, S.; Piekarz, H.; Wahl, H.; Womersley, J.; Hansen, S.; Hurh, P.; Rivetta, C.; Sanders, R.; Schmitt, R.; Stanek, R.; Stefanik, A. Florida State Univ., Tallahassee, FL (United States); Fermi National Accelerator Lab., Batavia, IL (United States). [1992]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-87ER40319. From 3. international conference on calorimetry in high energy physics; Corpus Christi, TX (United States); 29 Sep - 2 oct 1992. Order Number DE93018268. Source: OSTI; NTIS; INIS; GPO Dep.

A proposal for the fast sampling calorimetry with solid argon as active medium and the preliminary results from the solid argon test cell are presented. The proposed test calorimeter module structure, the signal routing and the mechanical and cryogenic arrangements are also discussed.

33651 (DOE/ER/40162–T6) **[Heavy ion nuclear physics research]: Progress report, 1991–1992.** Liu, X.T.; Petitt, G.A.; Zhang, Ziyang. Georgia State Univ., Atlanta, GA (United States). Dept. of Physics and Astronomy. [1992]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-84ER40162. Order Number DE93018862. Source: OSTI; NTIS; INIS; GPO Dep.

We have continued working on essentially the same projects during the period 1991–92 as reported on in our previous progress report. That is, R&D work on a dimuon detector for RHIC and work with the group at LANL on neutron induced fission measurements using the white neutron source at LAMPF. Our work has included participation in the RD-10 experiment at the AGS to study calorimeter/absorber optimization for a RHIC experiment. We have actively participated in the setup of the apparatus, the data-taking and the subsequent data analysis. We have used the Vax computer system in our department and the eight-processor Silicon Graphics system in the GSU computer center for most of the data analysis work. We have also continued our work on Monte Carlo simulations of various configurations of absorber/calorimeters for detection of electrons and muons in RHIC experiments. We have made increasing use of the Silicon Graphics computer for our work. Each processor has approximately the same power as a Decstation 5000 and we usually have essentially exclusive simultaneous use of three of the processors. We have installed GEANT 315 and PAW on this system. Since our Vaxstation was purchased before DECWINDOWS was a standard part of the Vax software we have been unable to use the Silicon Graphics computer for doing graphics with PAW and GEANT. We are attempting to solve this problem by installing X-Windows software on our 386SX system which is connected to the campus network. Our work at Los Alamos has consisted of participation in the LAMPF run during the summer of 1991 including constructing and setting up two new neutron detectors for the experiment. These projects are discussed in further detail in this paper.

33652 (DOE/ER/40678–T1) **The RDT-RPC technology option of GEM.** Michigan State Univ., East Lansing, MI (United States). 29 Jan 1993. 175p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER40678. Order Number DE93019853. Source: OSTI; NTIS; GPO Dep.

A muon system for the GEM SSCL detector based on Round Drift Tubes (RDT) has many attractive features. The Pt-trigger and beam crossing tag for the RDT tracking system can be accomplishment by either a PWC system, similar but less costly in design than Cathode Strip Chambers, or by a promising new type of RPC chamber. Given the economic construction of these chamber technologies a system can be envisioned with both good momentum reconstruction performance and pattern recognition capabilities. Full-scale chamber prototypes based on the RDT and RPC technologies have been constructed and tested successfully at the Texas Test Rig. Spatial resolutions have been measured in two designs of RDT chambers which meet or exceed the baseline resolution requirement of 100μm per chamber layer.

33653 (DOE/FTR–93014640) **Participation in meetings on two high energy physics experiments: The L3 experiment currently taking data at CERN's LEP collider and the GEM detector being designed for the superconducting supercollider.: Foreign trip report, February 20–May 10, 1992.** Wenaus, T.J. Lawrence Livermore National Lab., CA (United States). 2 Jun 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93014640. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report covers a two week period at LLNL, a GEM Collaboration meeting in Tucson, a two month period at the L3 experiment at CERN, Geneva, Switzerland, and participation in a data acquisition workshop in Viareggio, Italy. Activities covered by this trip arose from our collaboration on two high energy physics experiments, the L3 experiment currently taking data at CERN's LEP collider and the GEM detector being designed for the Superconducting Supercollider: Primary activities at CERN were continuation of work on L3 b physics analysis, activities related to L3 datataking, and maintenance of L3 simulation production on the large parallel computer of Livermore's Massively Parallel Computing Initiative (MPCI) project.

33654 (DOE/FTR–93014814) **Travel to Italy for discussions about Si Strip Detectors and a presentation at the VI European Symposium on Semiconductor Detectors: Foreign trip report, February 21–27, 1992.** Laakso, M. Fermi National Accelerator Lab., Batavia, IL (United States). 5 Mar 1992. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. Order Number DE93014814. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The main purpose of the trip was to present the paper 'Operation and Radiation Resistance of a FOXFET Biasing Structure for Si Strip Detectors' at the symposium. The biannual European Symposium on semiconductor detectors is the only specialized meeting on the subject of semiconductor detectors and related electronics in the world presently, and collects together the very best experts in the field. This year new developments were reported especially on the integration of readout electronics on the same silicon wafer with the detector components. Also developments in double-sided silicon strip detectors and associated electronics were extensively reported. Review talks were presented in closely related fields like gallium arsenide based infrared detectors, radiation damage mechanisms in Si detectors and thermal microcalorimetry. In technical discussions at INFN Padova radiation damage mechanisms in silicon strip detector biasing structures were talked about.

33655 (ETDE-IT–93-196) **Western European calibration cooperation (WECC) and its technical activitty in field of ionizing radiation.** Rotondi, E. (ENEA, Casaccia (Italy). Area Energia Ambiente e Salute). 1993. 4p. (CONF-9304196–1: Austrian-Italian-Hungarian radiation protection symposium, Obergurgl (Austria), 28-30 Apr 1993). Order Number DE93522930. Source: OSTI; NTIS (US Sales Only).

International trade, the exchange of scientific information, as well as, a multitude of pure and applied scientific and technological projects carried out on an international basis, are all highly dependent upon the validity of the measurement results. To this end, a fundamental contribution is obtained by using instruments calibrated with measurements whose values and uncertainties have been assigned with reference to national and international measurements standards. In order to fulfill the increasing need for accurate measurements, in many countries a national calibration system is already in place or is being established. The system is generally constituted by primary metrological institutes and by a network of calibration laboratories accredited by each national accreditation body as traceable to primary institutes in a specific field of measurements. Laboratory accreditation occurs in accordance with well established criteria. In Western Europe these criteria are laid down in the EN 45001 standard. Internationally, laboratories have to meet the criteria of ISO/IEC Guide 25. The experience, gained in many years of accreditation activity, has confirmed that the technical competence of a laboratory is effectively proved by proficiency tests. At an international level, interlaboratory comparisons are recognized as the most important means for building up and maintaining mutual confidence among calibration laboratories in different countries and among national accreditation bodies.

33656 (IHEP-OTF–91-176) **Simulation of the forward calorimeter for LHC detector.** Zmushko, V.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (Russian Federation). Inst. Fiziki Vysokikh Ehnergij. 1991. 25p. Order Number DE94600285. Source: OSTI; NTIS (US Sales Only); INIS.

Future collider experiments would need high-precision measurement of the missing transverse momentum and forward jets tagging. These tasks may be solved with help of the forward calorimeter. Simulation of the forward calorimeters for LHC detector so as to determine the requirements for its parameters, was made. It is shown that the calorimeter having a granularity up to 0.5x0.5, the energy resolution of 20% and 100% allows us to measure the missing transverse momentum with good precision and to determine the transverse momentum and the energy of jets with the accuracy of 10-20%. The influence of the hadronic shower size on the results of the simulation is estimated. 8 refs.; 16 figs.; 5 tabs.

33657 (INIS-RU–347, pp. 296) **Detection of light charged particles by scintillation phosphich detector.** Fomichev, A.S.; Ortlepp, Kh.G.; Kherbakh, K.; David, I.; Vagner, V.; Zejnalov, V.S.

AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. SCINTILLATOR-PHOTODIODE DETECTORS/charged particle detection

33658 (INIS-RU–347, pp. 297) **CsI(Tl) film scintillation of large area.** Avdeev, S.P. (and others); Karnaukhov, V.A.; Karch, V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. GLASS SCINTILLATORS/cesium iodides; ALPHA DETECTION; ENERGY DEPENDENCE; FILMS; HELIUM 4; LITHIUM 7; MONOCRYSTALS; NITROGEN 14

33659 (INIS-RU–347, pp. 383) **PhAZA - 4π installation for study on the fragments multiplex emission in nucleus-nucleus collisions.** Avdeev, S.P. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Karnaukhov, V.A.; Karch, V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. TIME-OF-FLIGHT SPECTROMETERS/multiplicity; TIME-OF-FLIGHT SPECTROMETERS/nuclear fragments; CAMAC SYSTEM; FOUR-PI COUNTING; PHOTOMULTIPLIERS; SI SEMICONDUCTOR DETECTORS; SOLID SCINTILLATION DETECTORS; TELESCOPE COUNTERS; TIME RESOLUTION; MULTIPLICITY

33660 (INIS-RU–347, pp. 384) **Detecting modulus on the silicon position sensitive detectors for the VASILISA separator.** Andreev, A.N. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Bogdanov, D.D.; Eremin, A.V.; Kabachenko, A.P.; Malyshev, O.N.; Ter-Akop'yan, G.M.; Chepigin, V.I.; Barkov, I.P.; Gazizov, I.M.; Stankevich, V.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. POSITION SENSITIVE DETECTORS/particle identification; POSITION SENSITIVE DETECTORS/si semiconductor detectors; ALPHA DECAY; ENERGY RESOLUTION; MEV RANGE 01-10; SPATIAL RESOLUTION

33661 (INIS-RU–347, pp. 385) **Total absorption spectrometer for measurement of the beta-decay force function.** Izosimov, I.N. (Radievyj Inst., Leningrad (Russian Federation)); Myakushin, M.Yu.; Rimskij-Korsakov, A.A.; Lazarev, Yu.A.; Shirokovskij, I.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs., 1 fig. GAMMA SPECTROMETERS/absorption spectroscopy; GAMMA SPECTROMETERS/beta detection; BETA DECAY; COINCIDENCE SPECTROMETRY; EFFICIENCY; ENERGY DEPENDENCE; ENERGY RESOLUTION; FOUR-PI COUNTING; KEV RANGE 100-1000; NAI DETECTORS

33662 (INIS-RU–347, pp. 388) **Position sensitive detector on the microchannel plates with different systems of data readout.** Valiev, F.F.; Makarov, N.I.; Sergeev, V.O.; Feofilov, G.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. POSITION SENSITIVE DETECTORS/readout systems; DATA ACQUISITION SYSTEMS; EFFICIENCY; ELECTRON DETECTION; KEV RANGE 100-1000; MICROCOMPUTERS; ON-LINE CONTROL SYSTEMS; SPATIAL RESOLUTION

33663 (INIS-RU–347, pp. 406) **References for beta-spectrometer calibration in low-energy range.** Kartashov, V.M. (AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki); Oborovskij, A.I.; Troitskaya, A.G. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. BETA SPECTROMETERS/calibration standards; AUGER ELECTRON SPECTROSCOPY; ELECTRON SPECTRA; EV RANGE 10-100; EV RANGE 100-1000; LUTETIUM 173

33664 (INIS-RU–347, pp. 412) **Measurement of the gadolinium characteristic radiation intensity on the ^{155}Eu decay.** Gudov, V.I. (Radievyj Inst., Leningrad (Russian Federation)); Egorov, A.G.; Nedovesov, V.G.; Rogozev, B.I.; Cherepanov, E.V.; Chereshkevich, Yu.L.; Shchukin, G.E. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. EUROPIUM 155/gamma radiation; EUROPIUM 155/x radiation; GAMMA SOURCES/europium 155; GAMMA SOURCES/gamma spectrometers; CALIBRATION; GADOLINIUM; ISOTOPE RATIO; ISOTOPE SEPARATION; K CAPTURE; KEV RANGE 10-100; LI-DRIFTED SI DETECTORS; SAMARIUM 152

33665 (INIS-RU–347, pp. 413) **Measurement of the KX- and soft gamma radiation component intensity on the ^{153}Gd decay.** Egorov, A.G. (Radievyj Inst., Leningrad (Russian Federation)); Chechev, V.P.; Shchukin, G.E. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. 7 refs., 1 tab. GADOLINIUM 153/gamma radiation; GADOLINIUM 153/x radiation; CALIBRATION; E2-TRANSITIONS; GAMMA SOURCES; K CAPTURE; KEV RANGE 10-100; LI-DRIFTED SI DETECTORS

33666 (INIS-RU–347, pp. 418) **On-line system for mass analysis of the gamma-emitting isotope content in environment samples.** Belyavenko, V.S. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Vishnevskij, I.N.; Gavrilyuk, V.I.; Donets, I.P.; Zheltonozhskij, V.A.; Lebedev, Yu.A.; Kharlanov, V.B. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. ON-LINE MEASUREMENT SYSTEMS/gamma radiation; ON-LINE MEASUREMENT SYSTEMS/radiation monitoring; ACTIVITY LEVELS; EFFICIENCY; ENERGY RESOLUTION; ENVIRONMENT; GAMMA SPECTROMETERS; GE SEMICONDUCTOR DETECTORS; ISOTOPE RATIO; KEV RANGE 100-1000; RADIOACTIVITY; SURFACE CONTAMINATION

33667 (INIS-RU–347, pp. 421) **Detection method in environment of hot particles as products of accident on the Chernobyl nuclear power plant.** Lyubinskij, N.N. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Melenevskij, A.Eh.; Romanova, E.P.; Fedyuk, E.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. RADIATION MONITORING/environment; ALPHA DETECTION; BETA DETECTION; CESIUM 144; CHERNOBYLSK-4 REACTOR; DEPTH DOSE DISTRIBUTIONS; GAMMA DETECTION; GAMMA DOSIMETRY; LI-DRIFTED GE DETECTORS; NAI DETECTORS; ENVIRONMENT; RADIOACTIVITY; REACTOR ACCIDENTS; RUTHENIUM 106; SURFACE CONTAMINATION

33668 (INIS-RU–347, pp. 426) **Scintillation detectors of charged particles with application of natural diamond crystal.** Kadkin, E.P. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Saltykov, L.S.; Grantsev, V.I.; Saenko, E.P.; Beskrovanov, V.V.; Timofeev, V.E. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. 1 tab. SOLID SCINTILLATION DETECTORS/diamonds; ALPHA DETECTION; AMPLITUDES; CRYSTAL COUNTERS; ENERGY DEPENDENCE; KEV RANGE 10-100; MEV RANGE 01-10; MEV RANGE 10-100; PERFORMANCE TESTING; PHOTOSENSITIVITY; PROTON DETECTION; DIAMONDS

33669 (INIS-RU–347, pp. 427) **Technique of study on quasi-continuous gamma spectra in inelastic nucleon-atomic nuclei interaction.** Besshejko, O.A. (Kievskij Gosudarstvennyj Univ., Kiev (Ukraine)); Degtyarev, A.P.; Mikhnitskij, I.B. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 fig. GAMMA SPECTRA/neutron reactions; GAMMA SPECTRA/spectra unfolding; ANGULAR DISTRIBUTION; EFFICIENCY; ENERGY SPECTRA; ERRORS; GAMMA RADIATION; MEV RANGE 01-10; NEUTRONS; OXYGEN 16; OXYGEN 16 TARGET

33670 (INIS-RU–347, pp. 434) **Wide-aperture coordinate scintillation spectrometer.** Stibunov, V.N. (Tomskij Politekhnicheskij Inst., Tomsk (Russian Federation). Inst. Yadernoj Fiziki, Ehlektroniki i Avtomatiki); Osipov, A.V.; Zhigalov, V.S.; Repenko, E.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. NEUTRON SPECTROMETERS/plastic scintillation detectors; PROTON SPECTROMETERS/plastic scintillation detectors; COINCIDENCE SPECTROMETRY; ENERGY RESOLUTION; PERFORMANCE TESTING; PHOTOMULTIPLIERS; SPATIAL RESOLUTION

33671 (INIS-RU–347, pp. 440) **Technique of the characteristic radiation apparatus spectra processing in X-ray spectral analysis by means of a SI(LI) detector.** Morgunov, Eh.I. (Kievskij Gosudarstvennyj Univ., Kiev (Ukraine)); Volkova, O.A.; Naumenko, E.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. 1 ref. SPECTRA UNFOLDING/x-ray spectra; ENVIRONMENT; LI-DRIFTED SI DETECTORS; POLLUTION CONTROL EQUIPMENT; QUANTITATIVE CHEMICAL ANALYSIS

33672 (INIS-RU–347, pp. 441) **Large area silicon spectrometric detectors and the alpha detection equipment on their base.** Konovalova, G.A. (Rizhskij Nauchno-Issledovatel'skij Inst., Radioizotopnogo Priborostroeniya, Riga (Latvia)); Popova, N.I.; Ivanchenko, S.N.; Popov, A.A.; Gostilo, V.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. 1 ref., 1 tab. SI SEMICONDUCTOR DETECTORS/alpha detection; SI SEMICONDUCTOR DETECTORS/surface barrier detectors; CARRIER LIFETIME; CHEMICAL POLISHING; ENERGY RESOLUTION; LEAKAGE CURRENT; MEV RANGE 01-10

33673 (INIS-RU–347, pp. 442) **On measurement of particle masses, knocked out from Au targets by high-energy heavy ions.** Baranov, I.A. (Radievyj Inst., Leningrad (Russian Federation)); Novikov, A.K.; Obnorskij, V.V.; Tsepelevich, S.O.; Bul'chenko, V.P.; Kozlov, B.N.; Pilyugin, I.I. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. 2 refs. MASS SPECTROSCOPY/heavy ion reactions; MASS SPECTROSCOPY/nuclear fragments; CALIFORNIUM 252; GOLD; ION PAIRS; MASS NUMBER; MASS SPECTROMETERS; MEV RANGE 10-100; TARGETS

33674 (INIS-RU–347, pp. 451) **Gamma spectra and processing system on the IBM PC/AT base.** Sabanin, B.P. AN

SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. GAMMA SPECTRA/spectra unfolding; CALIBRATION; COMPUTER CODES; DATA ACQUISITION SYSTEMS; GAMMA SPECTROMETERS; IBM COMPUTERS; MICROCOMPUTERS

33675 (INIS-RU–347, pp. 458) **Superconducting detectors of nuclear particles.** Rad'ko, V.E. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (Russian Federation). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. RADIATION DETECTORS/superconducting films; ENERGY RESOLUTION; NIOBIUM COMPOUNDS; SPATIAL RESOLUTION; TIME RESOLUTION; TITANIUM COMPOUNDS; TUNNEL EFFECT

33676 (INIS-RU–347, pp. 459) **Calculation of the semiconductor detector-dosimeter characteristics.** Smirnov, V.V. (Radievyj Inst., Leningrad (Russian Federation)); Grudskij, M.Ya.; Lebedev, A.G.; Serebryakov, A.S. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. DOSEMETERS/gamma dosimetry; DOSEMETERS/si semiconductor detectors; DOSEMETERS; EFFICIENCY; ENERGY DEPENDENCE; KEV RANGE 100-1000; MEV RANGE 01-10; THICKNESS

33677 (INIS-RU–353, pp. 43-47) **Angular fluctuations of Cherenkov radiation in gas due to dispersion.** Grishin, V.M.; Kotel'nikov, S.K. AN SSSR, Moscow (Russian Federation). Fizicheskij Inst. 1991. (In Russian). In *Short communications on physics. Experimental and theoretical physics. No. 9.* 48p. Order Number DE94600071. Source: OSTI; NTIS (US Sales Only); INIS.

The method for detection of the Cherenkov radiation (CR) rings used for identification of the relativistic charged particles (the so-called RICH detectors), was studied. The integral representation for the distribution $\phi_c(R)$ connected with dispersion, was obtained. The drift chambers filled with gas mixture with additions such as TMAE (tetramethylaminoethylen, $C_{10}H_{24}N$) and TEA(triethylamine, $C_6H_{15}N$), are usually used for measuring the CR ring radius R. The calculations were made for three spectral ranges: the visible one (300-600 nm), bialkaline cathode Sb-K-Cs; the ultraviolet one (165-220 nm), TMAE; and the vacuum ultraviolet one (145-165 nm), TEA. The dependence of the CR detection efficiency on energy of photons for different gases (Ar, CF_4, N) was also calculated.

33678 (LA-SUB–93-189) **A calorimeter for neutron flux measurement: Final report.** Chupp, T.E. (Harvard Univ., Cambridge, MA (US). Physics Labs.). Los Alamos National Lab., NM (United States); Harvard Univ., Cambridge, MA (United States). 1 Apr 1993. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93019301. Source: OSTI; NTIS; INIS; GPO Dep.

A calorimeter for absolute neutron flux measurement has been built and tested. The calorimeter measures the heat produced in a 10°K thick LiPb target when neutrons are captured via the $^6Li(n,^3H)^4He$ reaction. The sensitivity achieved was $1.3x10^6$ n/s for a 1 hour measurement. Separate flux measurements with the calorimeter and a ^{238}U fission chamber are in agreement and show that systematic errors are less than 3%. An improved calorimeter has been built which is sensitive to 10^5 n/s for a 1 hour measurement.

33679 (LA-UR–91-3572) **A compact neutron detector for a geology application.** Biddle, R.S.; Collinsworth, P.R. Los Alamos National Lab., NM (United States). 1991. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-911106–103: 1991 Institute of Electrical and Electronic Engineers (IEEE) nuclear science symposium and medical imaging conference, Santa Fe, NM (United States), 2-9 Nov 1991). Order Number DE93018564. Source: OSTI; NTIS; GPO Dep.

The authors recently designed and built a compact neutron detector for a geology experiment. The detector had to fit inside a 1.5-in.-diam borehole in a large block of concrete. They attached a gas-filled, 1-in.-diam ^3He tube to a 1-in.-diam electronics preamplifier package of their design. The electronics package consists of a cylindrically shaped, high-voltage section and a single-channel analyzer with a buffered output. The low-voltage components are mounted on a printed-circuit board. The circuit board and the high-voltage section are attached to a semicylindrical base. The outputs consist of a light-emitting diode for visual observations and a fixed-width, TTL-compatible pulse for a counter. This internal assembly is equipped with coaxial connectors and slips into a thin-walled tube that serves as the preamplifier housing. Power for a detector is supplied by an external, high-voltage supply and a 5-Vdc supply.

33680 (ORNL/FTR–3948) **Travel to Japan and China to address engineering issues related to the design of the barium fluoride calorimeter for the second detector at the Superconducting Super Collider Laboratory: Foreign trip report, May 24–June 2, 1991.** Moore, J.W.; Rennich, M.J.; Bauer, M.L. Oak Ridge National Lab., TN (United States). 24 Jun 1991. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93016414. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Discussions with Hamamatsu Photonics resulted in several proposals for a specific design photoriode readout for the barium fluoride calorimeter. Additional discussions were undertaken to inform Hamamatsu of the requirements for the Liquid Scintillating Hadron calorimeter readout. This led to a proposal for a special design multichannel readout which will be prototyped. Meetings with representatives of the Chinese crystal manufacturing institutes resulted in a clear understanding of the production requirements and capabilities. Current production problems with the initial prototype crystals were discussed and proposed solutions were evaluated. Decisions were made to act on several of the proposals; a tentative agreement for production of the final crystals was received.

33681 (ORNL/FTR–4632) **Travel to England to participate in the EUROGAM collaboration meeting held on the campus of the University of Liverpool: Foreign trip report, May 14–20, 1993.** Baktash, C. Oak Ridge National Lab., TN (United States). 23 Jul 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93019175. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The traveler presented an invited talk at the EUROGAM collaboration meeting which discussed the experimental results for two experiments, with the ORNL staff as the spokesmen. The meeting provided an excellent forum to hear and discuss the results from all experiments completed during the first phase of operation of EUROGAM at the Daresbury Laboratory. The traveler also explored the feasibility of moving the Daresbury recoil separator to ORNL to be used for the planned astrophysics experiments with radioactive ion beams.

33682 (ORNL/TM–12102) **Angular response characterization of the Martin Marietta Energy Systems, Inc., personnel dosimeter.** Ahmed, A.B.; McMahan, K.L.; Colwell, D.S. Oak Ridge National Lab., TN (United States). Aug 1993. 33p. Sponsored by

USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93019735. Source: OSTI; NTIS; INIS; GPO Dep.

An evaluation of the Martin Marietta Energy Systems, Inc., personnel dosimeter to radiation incident from non-perpendicular angles was carried out to meet the Department of Energy Laboratory Accreditation Program (DOELAP) requirements. Dosimeters were exposed to six different radiation sources. For each source, dosimeters were rotated about their horizontal and vertical axes at seven different angles each. Raw readings were processed through the dose calculation algorithm used for routine personnel dosimetry to determine dose equivalent values. Dose equivalent responses relative to zero degree incident angle were found to be within ± 20% for M150, K-59 and ^{137}Cs photons when the incident angle was 60° or less. For low-energy photon irradiations (M30 and K-16), responses for angles other than perpendicular incidence are generally unpredictable. Reasons include: (1) failure of dose calculation algorithm to identify the radiation field correctly due to unusual element ratios; and (2) at extreme angles (± 85°), the dosimeter design (in relation to the irradiation geometry) becomes the limiting factor in producing reproducible results. Response to ^{204}Tl beta particles decreases rapidly with increasing angle of incidence.

33683 (ORNL/TM–12300) **Design of an advanced TLD-based fixed nuclear accident dosimeter.** Casson, W.H.; Mei, G.T. Oak Ridge National Lab., TN (United States). Aug 1993. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93019856. Source: OSTI; NTIS; INIS; GPO Dep.

A new system has been designed for use as a fixed nuclear accident dosimeter based upon the thermoluminescent dosimeter (TLD) system used for personnel dosimetry at US Department of Energy facilities managed by Martin Marietta Energy Systems, Inc. The system is made up of a small phantom consisting of two main parts measuring 20 x 20 x 5 cm and made from polymethylmethacrylate. A neutron-sensitive TLD card is placed in the center between the two pieces. Also, TLD cards in standard holders are mounted on the front and back of the phantom. A derivation is made of a linear combination of the responses from the TLD elements which results in calculation of the neutron fluence, absorbed dose, and dose equivalent. By using the right linear combinations, a crude spectrum can be estimated, which allows further calculation of the average fluence-to-dose-equivalent conversion factor. The response of the system was tested and found to be applicable for the evaluation of typical nuclear accident spectra, although considerable improvement can be made by the addition of a sulfur pellet. The system was also tested for angular dependence. In order to move the development of this system from the proof-of-principle to full application, the calculation of the TLD resonse curves must be improved, additional measurements must be made, and the system must be tested in a simulated accident neutron field. The advantages of the new fixed dosimeter system are its simplicity, easy maintenance, and lower operational cost. The system uses standard TLD cards that are already in place throughout Energy Systems facilities. The TLD process personnel are famliiar with evaluating doses from TLDs and can provide information necessary to ensure timely and accurate assessment of exposures that may result from riticality accidents. Most of the quality control requirements are part of the existing personnel dosimetry system.

33684 (PNL-SA–22024) **A low power Multi-Channel Analyzer.** Anderson, G.A.; Brackenbush, L.W. Pacific Northwest Lab., Richland, WA (United States). Jun 1993. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930640–4: 8. IEEE conference on real-time computer applications in nuclear, particle and plasma physics, Vancouver (Canada), 8-11 Jun 1993). Order Number DE93017664. Source: OSTI; NTIS; INIS; GPO Dep.

The instrumentation used in nuclear spectroscopy is generally large, is not portable, and requires a lot of power. Key components of these counting systems are the computer and the Multi-Channel Analyzer (MCA). To assist in performing measurements requiring portable systems, a small, very low power MCA has been developed at Pacific Northwest Laboratory (PNL). This MCA is interfaced with a Hewlett Packard palm top computer for portable applications. The MCA can also be connected to an IBM/PC for data storage and analysis. In addition, a real-time time display mode allows the user to view the spectra as they are collected.

33685 (TRI-PP–90-72) **Some results on the use of avalanche photodiodes for scintillating fiber readout.** Salomon, M.; Kitching, J. TRIUMF, Vancouver, BC (Canada). Sep 1990. 4p. (CONF-9009123–: 13. international conference on plasma physics and controlled nuclear fusion research; 1990 Linear accelerator conference; Symposium on detector research and development for the Superconducting Super Collider, Washington, DC (United State Order Number DE94600286. Source: OSTI; NTIS (US Sales Only); INIS.

We have measured the properties of avalanche photodiodes (APDs) for possible use in conjunction with scintillating fibers as charged particle detectors. The quantities measured so far have been the gain of the APDs, the amplitude distribution of pulses from particles through the fibers, and the efficiency of detecting these particles. The preliminary results indicate the importance of the choice of associated electronics and good optical coupling between fiber and APD. The results obtained so far have been measured at room temperature and -100 C. (Author) (13 refs., 4 figs.).

33686 (UCRL-JC–113721) **HEGRS: Mechanical design of a high-energy, gamma-ray spectrometer.** Pedersen, K.B. Lawrence Livermore National Lab., CA (United States). 4 Jun 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9310123–1: 14. biennial Pan American Congress of Mechanical and Electrical Engineers, San Juan (Puerto Rico), 3-8 Oct 1993). Order Number DE93017192. Source: OSTI; NTIS; GPO Dep.

A large, 3200-kg (7000-lb) gamma-ray spectrometer was designed to move in a 1500 arc with an arc accuracy of 0.50, and to move radially over a distance of 650 mm (25 in.). The entire structure is aluminum rather than steel because of the high neutron background. The two-layer support accommodates rapid, accurate positioning of the spectrometer in both the rotational and radial directions within 0.1 mm (0.004 in.). All movements and positioning are computer-controlled. The centerline deviation over the entire surface is 0.25 mm (0.0100 in.). The bottom layer, called the table, permits arc motion. The table is a baseplate consisting of two 3.6-m x 1.2-m (12-ft x 4-ft) cast-aluminum jig plates. The top layer, called the sled, is an aluminum plate 2.12-m x 1.22-m (83.38-in. x 48-in.) wide, which provides for radial motion. Due to the large mass of the spectrometer and the accurate positioning required, air pads are used to facilitate movement. Hydraulic brakes are applied when the detector is in its rest position to comply with the seismic requirements of the installation.

33687 (UCRL-JC–113960) **The liquid helium thermosyphon for the GEM detector magnet.** Warren, R.P. Lawrence Livermore National Lab., CA (United States). 4 May 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930537–92: 5. annual international industrial symposium on the Super Collider and exhibition, San Francisco, CA (United States), 6-8 May 1993). Order Number DE93018638. Source: OSTI; NTIS; GPO Dep.

The GEM detector magnet, a horizontal solenoid 19.5 m in diameter and wound with a niobium-titanium cable in conduit, will be located with it's axis 19.5 m below grade. The conductor is wound on the inside of an aluminum bobbin which is cooled by liquid helium which flows by natural convection in a thermosyphon loop from a large storage dewar located at the ground surface. The function of the thermosyphon system is to absorb the environmental heat load as well as any internally generated heat. In the first category is included that heat which is transfered to the magnet by way of the mechanical supports, the insulation and the current leads. The internally generated heat includes the resistive heating within the normally conducting conductor splices and the inductive heating of the bobbin during current transients. Though similar systems have been employed elsewhere, there are some unique aspects to the present design. By taking advantage of the large vertical head available, the parallel heat exchanger passes within the magnet remain sub-cooled, thus insuring single phase coolant

within the magnet. It is believed that this will be the first instance of such a large vertical head being used to this advantage in a helium system.

33688 (UCRL-JC–114014) **Precision machining and polishing of scintillating crystals for large calorimeters and hodoscopes.** Wuest, C.R.; Fuchs, B.A. Lawrence Livermore National Lab., CA (United States). May 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930537–94: 5. annual international industrial symposium on the Super Collider and exhibition, San Francisco, CA (United States), 6-8 May 1993). Order Number DE93018663. Source: OSTI; NTIS; INIS; GPO Dep.

New machining and polishing techniques have been developed for large barium fluoride scintillating crystals that provide crystalline surfaces without sub-surface damage or deformation as verified by Atomic Force Microscopy (AFM) and Rutherford Back-scattering (RBS) analyses. Surface roughness of about 10–20 angstroms and sub-micron mechanical tolerances have been demonstrated on large crystal samples. Mass production techniques have also been developed for machining and polishing up to five 50 cm long crystals at one time. We present this technology along with surface studies of barium fluoride crystals polished with this technique. This technology is applicable for a number of new crystal detectors proposed at Colliders including the Barium Fluoride Electromagnetic Calorimeter at SSC, the Crystal Clear Collaboration's cerium fluoride calorimeter at LHC, and the KTeV and PHENIX scintillating hodoscopes at Fermilab, and RHIC, respectively. Lawrence Livermore National Laboratory (LLNL) has an active program of study on barium fluoride scintillating crystals for the Barium Fluoride Electromagnetic Calorimeter Collaboration and cerium fluoride and lead fluoride for the Crystal Clear Collaboration. This program has resulted in a number of significant improvements in the mechanical processing, polishing and coating of fluoride crystals. Techniques have been developed using diamond-loaded pitch lapping that can produce 15 angstrom RMS surface finishes over large areas. Also, special polishing fixtures have been designed based on mounting technology developed for the 1.1 m diameter optics used in LLNL's Nova Laser. These fixtures allow as many as five 25–50 cm long crystals to be polished and lapped at the same time with tolerances satisfying the stringent requirements of crystal calorimeters. We also discuss results on coating barium fluoride with UV reflective layers of magnesium fluoride and aluminum.

33689 (UCRL-JC–114015) **High rate resistive plate chambers: An inexpensive, fast, large area detector of energetic charged particles for accelerator and non-accelerator applications.** Wuest, C.R.; Ables, E.; Bionta, R.M.; Clamp, O.; Haro, M.; Mauger, G.J.; Miller, K.; Olson, H.; Ramsey, P. Lawrence Livermore National Lab., CA (United States). May 1993. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930537–96: 5. annual international industrial symposium on the Super Collider and exhibition, San Francisco, CA (United States), 6-8 May 1993). Order Number DE93018664. Source: OSTI; NTIS; INIS; GPO Dep.

Resistive Plate Chambers, or RPCs, have been used until recently as large detectors of cosmic ray muons. They are now finding use as fast large-area trigger and muon detection systems for different high energy physics detectors such the L3 Detector at LEP and future detectors to be built at the Superconducting Super Collider (SSC) and at the Large Hadron Collider (LHC) at CERN. RPC systems at these accelerators must operate with high efficiency, providing nanosecond timing resolution in particle fluences up to a few tens of kHz/cm^2 – with thousands of square meters of active area. RPCs are simple and cheap to construct. The authors report here recent work on RPCs using new materials that exhibit a combination of desirable RPC features such as low bulk resistivity, high dielectric strength, low mass, and low cost. These new materials were originally developed for use in electronics assembly areas and other applications, where static electric charge buildup can damage sensitive electrical systems.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

Refer also to citation(s) 34477

33690 (BNL–49017) **Studies of deep levels in high resistivity silicon detectors irradiated by high fluence fast neutrons using a thermally stimulated current spectrometer.** Li, Z. (Brookhaven National Lab., Upton, NY (United States)); Kraner, H.W.; Chen, W.; Beuttenmuller, R.; Biggeri, U.; Bruzzi, M.; Borchi, E.; Baldini, A.; Spillantini, P. Brookhaven National Lab., Upton, NY (United States). Apr 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-931107–2: Nuclear science symposium, San Francisco, CA (United States), 2-5 Nov 1993). Order Number DE93016133. Source: OSTI; NTIS; INIS; GPO Dep.

Measurements of deep level spectrum of high resistivity silicon detectors irradiated by high fluence fast neutrons (Φ_n: 2 x 10^{12}n/cm^2) have been made using a thermally stimulated current (TSC) spectrometer. It has been found that at least nine new defect levels, with peaking temperature of 19K, 27K, 36K, 44K, 49K, 83K, 93K, 105K, and 120K, begin to appear when $\Phi_n \geq 1 \times 10^{13}$n/cm. All peaks have strong dependences on the filling voltage (V_{fill}, forward bias) or injection current especially for high fluence ($\Phi_n \geq 10^{13}$ n/cm^2) situations. The defect concentration, energy level in the band gap, and cross section of each deep level, totaling, at least 13, have been studied systematically and possible identifications of the levels have been discussed.

33691 (INIS-RU–347, pp. 396) **Effects of radiation-stimulated improvement of the metal-semiconductor interface quality.** Kadmenskij, S.G. (Voronezhskij Gosudarstvennyj Univ., Voronezh (Russian Federation)); Levin, M.N.; Litmanovich, V.I.; Tatarintsev, A.V.; Chernyshev, V.E. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. SCHOTTKY BARRIER DIODES/physical radiation effects; SCHOTTKY BARRIER DIODES/semiconductor junctions; ELECTRIC CONDUCTIVITY; ELECTRON BEAMS; KEV RANGE 10-100; QUALITY CONTROL; SILICON DIODES

4405 Thermal Instrumentation

Refer also to citation(s) 32595, 32897

33692 (BNL–48563) **Temperature effects and corrections in volume measurements based on liquid-level detection.** Suda, S.; Keisch, B. Brookhaven National Lab., Upton, NY (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-930749–53: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93019044. Source: OSTI; NTIS; GPO Dep.

Temperature changes affect volume measurements in several ways. The dimensions of the tank, and the density and level of the liquid it contains vary with temperature. In addition, the response signal of the sensor and hence the response of the liquid-level detection device may change with temperature. Level measurement devices can be grouped according to four measurement points of reference: tip of probe, response proportional to the length of probe, top of tank, and liquid surface. This paper describes the physical principles of pressure, capacitance probe, sonic reflections, and visual scales. These are representative of the four types of liquid level detection techniques. Development of the temperature correction algorithm requires that the measurement process be clearly defined, conditions or limitations specified, and that a temperature-effects test be run. Although not difficult or necessarily time-consuming to run, good practice requires a test plan following demonstrated guidelines. Measurement control procedures for re-measurement of the process solution in the tank during normal

operation can provide data to validate temperature correction algorithms.

4406 Optical Instrumentation

Refer also to citation(s) 32897, 32958, 33237, 33439, 34422

33693 (LA-UR–93-2544) **An RS-170 to 700 frame per second CCD camera.** Albright, K.L. (Los Alamos National Lab., NM (United States)); King, N.S.P.; Yates, G.J.; McDonald, T.E.; Turko, B.T. Los Alamos National Lab., NM (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930722–17: Annual meeting of the Society of Photo-Optical Instrumentation Engineers (SPIE), San Diego, CA (United States), 11-16 Jul 1993). Order Number DE93018367. Source: OSTI; NTIS; GPO Dep.

A versatile new camera, the Los Alamos National Laboratory (LANL) model GY6, is described. It operates at a wide variety of frame rates, from RS-170 to 700 frames per second. The camera operates as an NTSC compatible black and white camera when operating at RS-170 rates. When used for variable high-frame rates, a simple substitution is made of the RS-170 sync/clock generator circuit card with a high speed emitter-coupled logic (ECL) circuit card.

33694 (LBL–34091) **Chemical dynamics in time and energy space.** Myers, J.D. Lawrence Berkeley Lab., CA (United States). Apr 1993. 233p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93018595. Source: OSTI; NTIS; GPO Dep.

The development of a versatile picosecond ultraviolet/vacuum ultraviolet temporal spectrometer and its potential use for measuring internal energy redistribution in isolated molecules are described in detail. A detailed description of the double-pass Nd:YAG amplifier and the dye amplifiers is given with the pulse energies achieved in the visible, ultraviolet, and vacuum ultraviolet. The amplified visible pulses are shown to be of sub-picosecond duration and near transform limited. The instrument's temporal response ($\leq$10 ps) is derived from an instrument limited measurement of the dissociation lifetime of methyl iodide at 266 nm. The methyl iodide experiment is used to discuss the various sources of noise and background signals that are intrinsic to this type of experiment. Non-time-resolved experiments measuring the branching ratio and kinetic energy distributions of products from the 193 nm photodissociation of cyclopentadiene and thiophene are presented. These studies were done using the molecular beam Photofragment Translational Spectroscopy (PTS) technique. The results from the cyclopentadiene experiment confirm that H atom elimination to yield the cyclopentadienyl radical is the dominant dissociation channel. A barrier of $\geq$5 kcal/mol can be understood in terms of the delocalization of the radical electron of the cyclopentadienyl fragment. A concerted elimination yielding cyclopropene and acetylene was also observed and is proposed to occur via a bicyclo-[2.1.0]pent-2-ene intermediate. Two other channels, yielding acetylene plus the CH_2CHCH triplet carbene, and CH_2 plus 1-buten-3-yne, are postulated to occur via ring opening. The implications of the experimental results for bulk thermal oxidation and pyrolysis models are discussed. The thiophene experiment shows six competing dissociation channels. The postulated intermediates for the various thiophene dissociation channels include bicyclo, ring opened, and possibly ring contracted forms.

33695 (SAND–93-0644) **Image blur.** Nissen, M.R. Sandia National Labs., Albuquerque, NM (United States). Apr 1993. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93017944. Source: OSTI; NTIS; GPO Dep.

The image blur in a photograph is produced by the exposure of a moving object. Knowing the amount of image blur is important for recording useful data. If there is too much blur, it becomes hard to make quantitative measurements. This report discusses image blur, the parameters used to control it, and how to calculate it.

33696 (UCRL-ID–113713) **Radiation induced darkening of the optical elements in the Startracker camera.** White, R.H.; Wirtenson, G.R. Lawrence Livermore National Lab., CA (United States). Mar 1993. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93018907. Source: OSTI; NTIS; INIS; GPO Dep.

Optical glass flats that closely simulate the elements used in the Startracker lens designs were exposed to doses of ionizing radiation ranging from 0.44 to 1300 krad. Photometer traces determined the transmittance of the samples as a function of both wavelength and dose for wavelengths in the range 300 to 1200 nm. Cerium stabilized glasses used in the radiation stabilized Startracker system showed only a small amount of darkening for doses up to and exceeding 1 Mrad. Glasses used in the unstabilized Startracker design showed significant darkening to visible and ultra-violet spectra for doses as low as 5 krad. Plots of transmittance versus wavelength for various doses are given for each of the Startracker optical elements. Radiation induced absorption parameters that determine the radiation induced absorption coefficient are tabulated and plotted versus wavelength.

33697 (WHC-SD-EN-TP–030) **Integrated test plan for the demonstration of a commercial Fourier Transform Infrared instrument.** Koegler, K.J. Westinghouse Hanford Co., Richland, WA (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018518. Source: OSTI; NTIS; GPO Dep.

This integrated test plan describes the use of a commercial Fourier Transform Infrared instrument for measuring Carbon Tetrachloride concentrations. The Fourier Transform Infrared will measure CCL4 concentrations in a line of sight path average mode in mass per cubic meter as a function of time. The goal of this test is to demonstrate the usefulness of a long path Fourier Transform Infrared instrument in determining CCL4 fluxes from the soil in the 200 area adjacent to disposal cribs where high soil fluxes are believed to exist. The instrument will be set up such that it can have a clear line of site path to it's reflector and this line of site will be as near to the Z-9 fence as possible and have a path length as long as possible.

4407 Geophysical and Meteorological Instrumentation

Refer also to citation(s) 33679, 33780

33698 (UCRL-ID–113953-Rev.1) **Comments on computational underwater acoustics: Revision 1.** Hedstrom, G. Lawrence Livermore National Lab., CA (United States). Jul 1993. 13p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93019880. Source: OSTI; NTIS; GPO Dep.

The authors discuss some of the considerations to take into account regarding the choice of methods for computational acoustics. They examine finite differences and finite elements, normal modes, and paraxial (parabolic) approximations. For each of these methods there is a class of problems for which it is well suited. Thus, finite differences and finite elements are best for short-range computations, normal modes are restricted to nearly-stratified media, and paraxial approximations work well when the signal is confined to the underwater sound channel. The authors discuss the reasons behind this state of affairs. They also point out some characteristics of these methods which are important for the numerical applications. It is concluded that the method of normal modes is numerically the most efficient computational method for underwater acoustics when it is a valid approximation. That is, one should use normal modes when the medium is nearly horizontally stratified. Paraxial approximations are very attractive for propagation in an underwater sound channel. They may be modified to incorporate interaction with a solid bottom if the wave speeds in the bottom are close to the speed of sound in water. Thus, an uncompacted solid bottom is not a great difficult for paraxial approximations. The numerical methods which are most flexible with respect to wide ranges of material properties use finite differences or finite elements, but such methods are only feasible for computation over short distances.

4408 Miscellaneous Instrumentation

Refer also to citation(s) 32153, 32191, 33316, 33399, 33424, 33428, 33763, 33783, 34501, 34514

33699 (CONF-930755–3) **Atomic resolution electron energy loss spectroscopy in the scanning transmission electron microscope.** Browning, N.D.; Chisholm, M.F.; Pennycook, S.J. Oak Ridge National Lab., TN (United States). [1993]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 6. analytical electron microcopy (AEM) workshop; Los Angeles, CA (United States); 11-16 Jul 1993. Order Number DE93015334. Source: OSTI; NTIS; GPO Dep.

Electron energy loss spectroscopy (EELS) in the scanning transmission electron microscope (STEM) is an invaluable tool for the microanalysis of materials, providing information on both compositional and electronic structure fluctuations on the sub-nanometre scale. To utilise fully the high resolution potential of the energy loss signal, it is essential to have a reference high-resolution image showing the atomic structure in the region of study. The recently developed high-resolution Z-contrast imaging technique for the STEM, provides an intuitive reference image of the atomic structure that, as both imaging and microanalysis can be performed simultaneously, can be conveniently used to position the electron probe over individual atomic columns. The spatial resolution of both the image and the energy loss spectrum can be identical, and in principle limited only by the probe size of the microscope. Therefore, for the 2.2Å probe size of the VG HB501 UX dedicated STEM, there exists the ability to be able to resolve individual atomic columns or planes.

33700 (DOE/EW/50616–T13) **Earth Penetration Radar Imaging System (EPRIS): Final report.** Coleman Research Corp., Orlando, FL (United States). Aug 1993. 83p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract AI01-92EW50616. Contract DAAA21-90-D-0007. Order Number DE93019890. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The Earth Penetration Radar Imaging System (EPRIS) has been developed and has the capability to detect and locate buried mines, buried ordnance delivered by precision munitions, buried drums, buried waste/contaminants, and geological structures/features. The detected objects or features are mapped in three dimensions with high resolution. This information is then available for integration into a site characterization study. The EPRIS is a significant improvement in non-intrusive sensing and imaging capability. This phase of the EPRIS development has been extremely successful. Coleman Research Corporation (CRC) has implemented significant advances in technology into the EPRIS equipment. The frequency stepped radar sensor design has a very wide dynamic signal range and improved sensitivity over currently available equipment. The two- and three-dimensional image processing algorithms allow high-resolution placement and sizing of buried objects and/or features. The discussions related to the analog-to-digital converter and the spiral antenna, define the source of the dynamic range capability realized by EPRIS. The processing for this new radar makes use of unique synthetic aperature imaging (SAI) algorithms developed by CRC for frequency stepped radar systems. The SAI algorithms are necessary to obtain excellent spatial resolution on objects buried up to seven meters. The sensor signal processing represents a significant improvement in imaging systems. The CRC test facility permitted tests on objects buried up to 2.44 meters.

33701 (SAND–92-2844) **Development of a quartz digital accelerometer for environmental sensing and navigation applications.** Kass, W.J.; Vianco, P.T. Sandia National Labs., Albuquerque, NM (United States). Mar 1993. 138p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018503. Source: OSTI; NTIS; INIS; GPO Dep.

A quartz digital accelerometer has been developed which uses double ended tuning forks as the active sensing elements. The authors have demonstrated the ability of this accelerometer to be capable of acceleration measurements between ±150G with ±0.5G accuracy. They have further refined the original design and assembly processes to produce accelerometers with < 1mG stability in inertial measurement applications. This report covers the development, design, processing, assembly, and testing of these devices.

33702 (SAND–93-0882C) **Experiments and analysis of lateral piezoresistance gauges.** Wong, M.K.W. Sandia National Labs., Albuquerque, NM (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930676–13: 14. international conference of the International Association for the Advancement of High Pressure Science and Technology, Colorado Springs, CO (United States), 27 Jun - 2 jul 1993). Order Number DE93017874. Source: OSTI; NTIS; GPO Dep.

The response of lateral piezoresistance gauges to shock wave uniaxial strain loading has been examined in a combined experimental and calculational effort. Plate impact experiments provided lateral gauge data which were analyzed using quasi-static and dynamic inclusion analyses. Experimental data showed that the response of the lateral gauge output depended upon the matrix material and gauge emplacement method. The calculations indicated that these differences were due to complex gauge-matrix interactions. These interactions were influenced by the stress and strain distributions in and around the gauge, plasticity effects, properties of the gauge and matrix materials, and emplacement conditions.

33703 (SAND–93-1232) **Calibration of accelerometers at the Dropball Station.** Rebarchik, F.N. Sandia National Labs., Albuquerque, NM (United States). Aug 1993. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93019309. Source: OSTI; NTIS; GPO Dep.

This memorandum is a synopsis of the description and operation of the equipment used and the events occurring during the calibration of various accelerometers at the Dropball Station.

45 MILITARY TECHNOLOGY, WEAPONRY, AND NATIONAL DEFENSE

Refer also to citation(s) 32606, 32607, 32610, 33205, 33333, 33797, 34687

33704 (DOE/FTR–93013405) **[Travel to Aldermaston, UK for the SUBWOG 6P meeting and to Noordwijk, Netherlands and Abingdon, England to visit the European Space Research and Technology Center and AEA Industrial Technology, Culham Laboratory]: Foreign trip report, May 29–June 10, 1992.** McGlaun, J.M.; Chhabildas, L.C.; Asay, J.R. Sandia National Labs., Albuquerque, NM (United States). 23 Jul 1992. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93013405. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of the trip was to participate in a Technical Exchange Subcommittee meeting as a part of the SUBWOG-6P Joint US/UK Workshop, organized by the Atomic Weapons Establishment, Aldermaston, England. The SUBWOG-6P Meetings are the vehicle for the exchange of information between the United Kingdom and the United States on areas of mutual interest in Kinetic Energy Italy and Vulnerability. The meeting was organized by Dr. Nigel Fenner of the Atomic Weapons Establishment, and had participants at the meeting from Great Britain and the United States. Britain was represented by their staff from the Atomic Weapons Establishment at Aldermaston and Foulness. The United States had representatives from the Strategic Defense Initiative Office, US Army Strategic Defense Command, Defense Nuclear Agency, Lawrence Livermore National laboratory, Los Alamos National Laboratory, Sandia National Laboratory, Naval Surface Warfare Center, and Kaman Sciences. The development of hypervelocity launchers, weapon effects related to kinetic energy lethality, and the development of hydrodynamic codes and phenomenological KAPP codes for use to assess weapon effects and damage were among the topics discussed at this meeting.

33705 (DOE/FTR–93015301) **Travel to Germany for meeting on important future issues facing the NATO alliance: Foreign trip report, March 5–10, 1992.** Robinson, C.P. Sandia National

Labs., Albuquerque, NM (United States). 31 Mar 1992. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93015301. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of this trip was to participate in the Fifth Review on the Future Tasks of the Atlantic Alliance, a meeting led by Manfred Worner, Secretary General of NATO, held at Stiftung Wissenschaft und Politik (Institute for Science and Politics), Ebenhausen (nur Munich), Germany. Worner established these meetings to provide an off-the-record forum for "decision makers" within the Alliance to interact with invited policy, scientific, and think-tank leaders in an examination of the important issues facing the NATO Alliance in the future. The meeting focused on contingency planning for the further evolution of events within Europe: in particular, the likely further disintegration of the Commonwealth of Independent States (CIS), the economic and political future of the new Eastern Europe state, and the potential for other threats or crises for the Alliance from outside the European region. Predominant views were that the future evolution of the territories to the east of the NATO countries will be chaotic. The CIS was believed to be incapable of lasting beyond the end of the year and, because of political instability, we may very well be faced with the further breakup of the Russian Republic itself in the near future.

33706 (DOE/FTR–93015528) **Travel to France regarding research on photoconductive semiconductor switches, optoelectronics, and low impedance anode plasma source drivers: Foreign trip report, May 6–21, 1993.** Loubriel, G.M. Sandia National Labs., Albuquerque, NM (United States). 14 Jun 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93015528. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The conference in Bordeaux was attended by US and French scientists. There was no European experimental work on impulse radar. Most of the work was theoretical, and concentrated on laser impulses and their interaction with matter. Some across section calculations for stealth bombers were presented. At Thomson-CSF I saw labs working on: optoelectronic signal processing for phased array antennas, laser diode arrays, and microwave communications. The U. of Braunschweig has an effort similar to ours: I toured their GaAs switch research facility and the impulse transmitter lab.

33707 (LA-SUB–93-246) **[Conceptual designs integrating electric guns on mobile platforms].** Los Alamos National Lab., NM (United States). 1993. 25p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93018284. Source: OSTI; NTIS (US Sales Only); GPO Dep.

During the period December 1988-March 1989, FMC conducted a design study for Los Alamos National Laboratory. The purpose of the study was to develop conceptual designs integrating electric guns on mobile platforms which represent weapon systems that meet mission requirements defined by BDM Corporation. BDM provided the mission area information based on guidance from the DARPA Electric Energy Gun System Study Panel. Mission areas for which FMC developed concepts were Fire Support and Anti-Armor. The Fire Support area was focused on the artillery role and Anti-Armor area was focused on the Main Battle Tank and Tank Destroyer roles. These concepts were also provided as support to BDM in their presentation at the Electrical Energy Gun System Study briefing at System Planning Corporation in Arlington, Virginia on February 1st, 1989. The top level presentation material (which includes information developed separately by BDM) has been classified Secret and is not provided in this report. The EEGSS classified final report is currently in review by DARPA prior to publication.

33708 (SAND–92-2397) **Equation of state and fragmentation issues in computational lethality analysis.** Trucano, T.G. Sandia National Labs., Albuquerque, NM (United States). Jul 1993. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018680. Source: OSTI; NTIS; GPO Dep.

The purpose of this report is to summarize the status of computational analysis of hypervelocity impact lethality in relatively nontechnical terms from the perspective of the author. It is not intended to be a review of the technical literature on the problems of concern. The discussion is focused by concentrating on two phenomenology areas which are of particular concern in computational impact studies. First, the material's equation of state, specifically the treatment of expanded states of metals undergoing shock vaporization, is discussed. Second, the process of dynamic fragmentation is addressed. In both cases, the context of the discussion deals with inaccuracies and difficulties associated with numerical hypervelocity impact simulations. Laboratory experimental capabilities in hypervelocity impact for impact velocities greater than 10.0 km/s are becoming increasingly viable. This paper also gives recommendations for experimental thrusts which utilize these capabilities that will help to resolve the uncertainties in the numerical lethality studies that are pointed out in the present report.

33709 (SAND–93-0332C) **Perforation of HY-100 steel plates with long rod projectiles.** Hanchak, S.J. (Univ. of Dayton Research Inst., OH (US). Impact Physics Lab.); Altman, B.S.; Forrestal, M.J. Sandia National Labs., Albuquerque, NM (United States). 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9308133–1: Army symposium on solid mechanics, Plymouth, MA (United States), 17-19 Aug 1993). Order Number DE93017654. Source: OSTI; NTIS; GPO Dep.

The authors conducted perforation experiments with 4340 steel, rod projectiles and HY-100 steel, target plates at striking velocities between 80 and 370 m/s. Projectiles were machined to nominally 30-mm-diameter and 281-mm-length so they could be launched from a 30-mm-powder gun without sabots. The target plates were rigidly clamped at 305-mm diameter and had a nominal thickness of 10.2 mm. In addition to measuring striking and residual projectile velocities, they obtained back surface framing camera data that showed clearly the plate deformation and plug ejection process. An Imacon 792 camera provided up to 20 frames per experiment with an interframe time duration of 10 μs. The modeling work is in progress, but they present a beam model that exhibits the features observed in the experiments.

33710 (SAND–93-0389C) **Debris cloud characterization at impact velocities of 5 to 11 km/s.** Chhabildas, L.C.; Boslough, M.B.; Reinhart, W.D.; Hall, C.A. Sandia National Labs., Albuquerque, NM (United States). 1993. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930676–28: 14. international conference of the International Association for the Advancement of High Pressure Science and Technology, Colorado Springs, CO (United States), 27 Jun - 2 jul 1993). Order Number DE93018832. Source: OSTI; NTIS; GPO Dep.

A series of experiments has been performed on the Sandia HyperVelocity Launcher to impact a 1.25-mm thick aluminum bumper by an aluminum flier plate 17-mm diameter by 0.92-mm thick over the velocity range of 5 km/s to 11 km/s. Radiographic techniques were employed to record the debris cloud generated upon impact. The shape of the debris cloud is found to depend on the flier plate tilt. Generally – the data indicate a central core of higher density surrounded by a diffused layer. These experiments allow measurements of debris cloud expansion velocities as the material undergoes a phase change from solid fragments at impact velocities of 5 km/s to a mixture of liquid and vapor phase at higher impact velocities. The expansion velocity of the debris cloud increases with increasing impact velocity, with the high-density leading edge traveling faster than the impact velocity. There is a difference between the X-ray and photographic measurements of expansion velocities at higher impact velocities. This is believed to be due to the presence of very low-density vapor in the photographic records that are not detecting using X-ray techniques.

33711 (SAND–93-1674C) **A systems engineering/human factors approach to human machine interface design for aided target acquisition.** Kuperman, G.G. (Armstrong Lab., Wright-Patterson AFB, OH (United States)); Sobel, A.L. Sandia National Labs., Albuquerque, NM (United States). [1993]. 22p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9308134–1-Vugraphs: National fire control symposium, Boulder, CO (United States), 3-5 Aug

1993). Order Number DE93017502. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A systems/human engineering approach employing decision-assisting algorithms, ie, automatic target cuers and recognizers, (ATCs and ATRs) has been under development by the military service laboratories for well over a decade. Two major system applications have been addressed: target acquisition (for weapon delivery) and imagery interpretation (for reconnaissance exploitation). The objective of the target acquisition application has been cue preselected targets to a weapon systems operator. The expected benefits of this application have been to overcome the extreme time compression typical of air-to-ground attack against possibly defended fixed and mobile targets, to reduce crew workload, to simultaneously minimized missed targets and false alarms (i.e., nontargets incorrectly cued as targets), and to support single-pass attack tactics (avoiding repeated exposure of the attacking aircraft to terminal area threats). The reconnaissance support application, automated imagery exploitation, does not reflect either the extremely short timelines or severe survivability risks. Rather, this application is of interest because of the extremely large amounts of imagery that must be interpreted. Although reconnaissance missions are normally tasked against specific target (or potential target) locations, all coverage must eventually be reviewed by a human interpreter. Hence, the goal of automated image exploitation is to (relatively) rapidly review large amounts of imagery while minimizing the number of targets missed during the process. Similarly, the applications of interest encompass a variety of sensing phenomenologies: synthetic aperture radar (SAR), forward looking infrared (FLIR), laser detection and ranging (LADAR), etc. Each sensor class is capable of obtaining distinct target signature information and each is characterized by distinctive vulnerabilities to atmospheric and range-to-target conditions.

33712 (UCRL-ID–113763) **Alternatives to matched-field processing: An overview of the model-based approach.** Candy, J.V. (Lawrence Livermore National Lab., CA (US)); Sullivan, E.J. Lawrence Livermore National Lab., CA (United States). 26 Mar 1993. 21p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-48. Contract N00014-91-F-0114. Order Number DE93017949. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The location of acoustical sources in a cluttered and noisy ocean environment is a difficult problem especially in light of the improved design of modern submarines. Therefore, it is necessary to incorporate more knowledge about the ocean environment into detection and localization algorithms in order to enhance the overall signal-to-noise ratios and improve performance. Recently, there have been many improvements to the signal processing of acoustical sources in the literature especially in the area of high resolution spatial processing (beamforming) for passive localization. Beamforming incorporates information on the "assumed" wavefront, here the the direction vector of an impinging plane wave source. As the ocean environment becomes more and more complicated, such as in our case, then the "plane wavefront" model fails, leading to severe beamformer performance degradation. In an effort to improve the performance of the beamformer for complex ocean environments – the matched-field processor has evolved as a potential solution. An alternative methodology to matched-field/matched-mode processing is the so-called model-based approach which is based on a state-space representation of the normal-mode propagation model. If state-space solutions can be accomplished, then many of the current ocean acoustic processing problems can be analyzed and solved offering a different and hopefully more revealing and intuitive framework to analyze results based on firm statistical and system theoretic grounds. In this application, the authors seek techniques to incorporate the (1) ocean acoustic propagation model; (2) sensor array measurement model; and (3) noise models (ambient, shipping, surface and measurement) into a processor to solve the associated signal enhancement/detection problems.

4501 Chemical Explosions and Explosives

Refer also to citation(s) 33315, 33700

33713 (DOE/EA–0810) **Environmental Assessment for the ammunition storage facility at the Savannah River Site.** US-DOE Savannah River Field Office, Aiken SC (United States). Dec 1992. 6p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93016910. Source: OSTI; NTIS; GPO Dep.

The Savannah River Site (SRS), a DOE national defense facility. The SRS maintains an armed and uniformed protective force that performs patrol, guard, and monitoring activities on site. A safe, secure storage facility is needed for the storage of weapons, small arms ammunition, and explosives that may be used in carrying out such activities. This Environmental Assessment assesses the potential environmental and related safety impacts of constructing a small storage facility to replace the existing facility being used to store these munitions. Constructing a new storage facility is necessary to enable SRS to meet DOE requirements and any other applicable standards including DOE Order-6430.1A, General Design Criteria; - 5632.7, Protective Forces; - DOE Manuals-DOE/TIC 11268, Manual for Prediction of Blast and Fragment Loading for Structures; - DOE/EV 06194-5, and Explosives Safety Manual. Additionally, this action is needed because the present facility, the Building 217-F vault, does not comply with the above criteria for storage of munitions and explosives, and has been cited with seven occupational safety violations by DOE safety engineers. The most serious noted violations are due to the existing lack of appropriate storage space: munitions stacked directly against masonry walls, weapons stored in the same magazine as the munitions, inoperable ventilation system, inadequate air circulation, and the existence of electrical fans and switchgear within the magazine.

33714 (LA-SUB–93-201) **Pyrotechnic study and test: Final report.** Smith, R.D. (Unidynamics/Phoenix, AZ (US)); Fronabarger, J.W. Los Alamos National Lab., NM (United States); Unidynamics/Phoenix, Inc., AZ (United States). 14 Jan 1992. 12p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93019297. Source: OSTI; NTIS; GPO Dep.

Unidynamics/Phoenix entered into LANL contract #9-X51-D9928-1 on March 11, 1991. The contract was to perform chemical analysis and provide analytical data, provide test data from functioning units, build and test pyrotechnic devices and fabricate and test approximately 100 pyrotechnic devices to approximate the chemical and functioning characteristics of the devices from the Army inventory. Because of government regulations, it became nearly impossible to ship the units from White Sands to Unidynamics. Consequently a series of functional tests were conducted at White Sands Missile Range. Comments on the functional tests are included herein. In addition, small scale tests were conducted at Unidynamics. These tests were to demonstrate a so called "line" charge and a "walking" charge. A discussion of these two charges is presented. The program was put on hold on November 6, 1991 and subsequently reopened to prepare and submit this report.

33715 (LA-UR–93-2345) **Response of inclined electromagnetic particle velocity gauges in shocked liquids.** Gustavsen, R.L.; Sheffield, S.A.; Alcon, R.R. Los Alamos National Lab., NM (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930676–20: 14. international conference of the International Association for the Advancement of High Pressure Science and Technology, Colorado Springs, CO (United States), 27 Jun - 2 jul 1993). Order Number DE93018352. Source: OSTI; NTIS; GPO Dep.

Multi-element electromagnetic particle velocity gauges are made by sandwiching aluminum conductive elements between sheets of Teflon. The 60 μm thick membrane is then placed in the liquid sample at an angle so that particle velocities are measured at multiple depths. In this paper we report particle velocity measurements in the liquids nitromethane, bromoform and diiodomethane using Teflon gauges inclined to the shock front by 0, 10, 20, and 30 degrees. The particle velocity measured by the inclined gauges was either higher or lower than the "correct" particle velocity measured by non inclined gauges. The error in the measured particle velocity is a function both of the relative impedance of the liquid and Teflon membrane, and of the angle of the gauge to the shock front. Measured velocities can be in error by $\pm$ 10% for gauges inclined 30°.

Analysis shows that some of the error is caused by the liquid slipping past the Teflon membrane.

33716 (LA-UR–93-2347) **Particle velocity and stress measurements in low density HMX.** Sheffield, S.A. (Los Alamos National Lab., NM (United States)); Gustavsen, R.L.; Alcon, R.R.; Graham, R.A.; Anderson, M.U. Los Alamos National Lab., NM (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930676–18: 14. international conference of the International Association for the Advancement of High Pressure Science and Technology, Colorado Springs, CO (United States), 27 Jun - 2 jul 1993). Order Number DE93018350. Source: OSTI; NTIS; GPO Dep.

Magnetic particle velocity gauges and PVDF stress rate gauges have been used to measure the shock response of low density HMX explosive (1.24 g/cm^3). In experiments done at LANL, magnetic particle velocity gauges were located on both sides of the explosive. In nearly identical experiments done at SNL, PVDF stress rate gauges were located at the same positions. Using these techniques both particle velocity and stress histories were obtained for a particular experimental condition. Loading and reaction paths were established in the stress-particle velocity plane for each input condition. This information was used to determine that compacted HMX has an impedance close to that of Kel-F and also that a global reaction rate of $\approx 0.13\ \mu s^{-1}$ was observed in HMX shocked to about 0.8 GPa. At low input stresses the transmitted wave profiles had long rise times (up to 1 μs) due to the compaction processes.

33717 (LA-UR–93-2348) **Contained high explosive firing facility (CHEFF).** Stacy, H.L. (Los Alamos National Lab., NM (United States)); Seitz, W.L.; Wackerle, J.; Polcyn, M.; Esparza, E. Los Alamos National Lab., NM (United States); Southwest Research Inst., San Antonio, TX (United States). 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930676–24: 14. international conference of the International Association for the Advancement of High Pressure Science and Technology, Colorado Springs, CO (United States), 27 Jun - 2 jul 1993). Order Number DE93018349. Source: OSTI; NTIS; GPO Dep.

A cylindrical vessel capable of totally containing the products and shrapnel resulting from the detonation of 10 kg of TNT (or equivalent) has been designed and built by Southwest Research Institute for and according to the requirements of the Detonation Systems Group (M-7) of Los Alamos National Laboratory. The vessel is 6.0-m long by 3.6-m diameter and is manufactured of 50-mm (elliptical end caps) and 38-mm (cylindrical walls) thick high-strength steel (HY-100). The cylindrical walls of the vessel are lined with 13-mm thick replaceable steel plates for shrapnel protection. The floor is made of steel-covered concrete. Ten large-aperture (254 mm) optical ports are available for instrumentation and four ports are provided for cabling and plumbing. Two qualifying detonation tests of 8.8 kg of C-4 explosive (equivalent to 10 kg TNT) have shown that the maximum strain produced is less than 78% of the elastic limit. The vessel is installed in a converted outdoor firing facility that has been modified to include an insulated and heated metal building to house the vessel and additional instrumentation. A computer-based system for data acquisition, firing control, and the monitoring of vessel response is described.

33718 (LA-UR–93-2547) **Initiation of preshocked high explosives PBX-9404, PBX-9502, PBX-9501, monitored with in-material magnetic gauging.** Mulford, R.N.; Sheffield, S.A.; Alcon, R.R. Los Alamos National Lab., NM (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930713–21: 10. detonation symposium, Boston, MA (United States), 12-16 Jul 1993). Order Number DE93018365. Source: OSTI; NTIS; GPO Dep.

Desensitization of explosives by preshocking is being studied using the well-supported plane shock waves generated by a gas gun. Evolution of the waves in the explosive is monitored using in-material multiple magnetic gauges to measure particle velocity in the lagrangian frame, over $\approx 3\mu$s of run. PBX-9404, PBX-9502 have been studied, at pressures up to 10.5 GPa. A substantial extension of the run to detonation is observed in PBX-9404, with the run beginning approximately at the end of the preshocked region. A reactive wave is observed while the preshock persists in both PBX-9404 and PBX-9501, but evidently does not contribute to the detonation wave or shorten the run to detonation. PBX-9502 is inert at pressures accessible with the gas gun, but serves to clarify the progress of multiple shocks over the off-Hugoniot EOS surface and the shock dynamics of wave coalescence.

33719 (LA-UR–93-2548) **Velocimetry studies on the prompt initiation of PBX 9502.** Wackerle, J.; Stacy, H.L.; Seitz, W.L. Los Alamos National Lab., NM (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930713–20: 10. detonation symposium, Boston, MA (United States), 12-16 Jul 1993). Order Number DE93018364. Source: OSTI; NTIS; GPO Dep.

In this paper, a description is given for the extension and refinement of the methods used for the investigation of the reaction-rate evolution in the prompt initiation of PBX9502 (95 wt percent TATB/ 5 wt percent Kel F 800). A further improvement was realized in the experimental configuration of 9SD, which already was sufficient to resolve considerable detail in the detonation reaction zones. In this study, the interface velocity histories where obtained on specimens with thicknesses less that the approximately 3-mm run distance needed to establish a nearly steady detonation reaction zone with the driving system. Within this experimental range, an initally rounded character was observed in velocity histories, and the quantitative measurements of the evolution of this feature during the prompt initiation buildup process provide the significant new experimental information of this paper.

33720 (LA-UR–93-2550) **Reflected-shock initiation of explosives.** Ferm, E.N.; Hull, L.M. Los Alamos National Lab., NM (United States). 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930713–22: 10. detonation symposium, Boston, MA (United States), 12-16 Jul 1993). Order Number DE93018559. Source: OSTI; NTIS; GPO Dep.

In a study of initiations caused by reflected shock from a high-impedance boundary, attempts to establish sufficient conditions for initiative are described. Shock polar analysis is used to discover the ranges of various flow regimes, general shock structures and pressure estimates of states behind the reflected wave. Using this knowledge, wave structure growth rates from hydrocode simulations are estimated and standard-shock initiation criteria are used; experiments are designed in which the initiation from a reflected-shock wave structure appears likely. Two experiments are described in which a reflected-shock wave from a uranium surface initiated PBX 9502. The experimental evidence is in good agreement with the assumptions and results of the analysis.

33721 (UCRL-CR–113692) **Exploratory depth-of-burst experiments.** Reichenbach, H. (Fraunhofer-Institut fuer Kurzzeitdynamik - Ernst-Mach-Institut (EMI), Freiburg im Breisgau (Germany)); Behrens, K.; Kuhl, A. Lawrence Livermore National Lab., CA (United States); Fraunhofer-Institut fuer Kurzzeitdynamik - Ernst-Mach-Institut (EMI), Freiburg im Breisgau (Germany); R and D Associates, Los Angeles, CA (United States). 12 Dec 1991. 45p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93019609. Source: OSTI; NTIS; GPO Dep.

This report describes the first small-scale explosion experiments with aerated grout (i.e., YTONG). Apart from data referring to crater depth and volume versus depth of burst (DOB), isobaric DOB curves in the range of 1.5 psi $\leq p \leq$ 15 psi were established. The comparison with previous HOB values shows that the ground range to a given overpressure is considerably reduced with increasing depth of burst. The authors plan to continue the airblast investigations with different types of soil materials.

33722 (UCRL-CR–114509) **Temperature of aircraft cargo flame exposure during accidents involving fuel spills.** Mansfield, J.A. Lawrence Livermore National Lab., CA (United States). Jan 1993. 299p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (DDV–93-0004). Order Number DE93019633. Source: OSTI; NTIS; GPO Dep.

This report describes an evaluation of flame exposure temperatures of weapons contained in alert (parked) bombers due to accidents that involve aircraft fuel fires. The evaluation includes

two types of accident, collisions into an alert aircraft by an aircraft that is on landing or take-off, and engine start accidents. Both the B-1B and B-52 alert aircraft are included in the evaluation.

33723 (UCRL-ID–113275) **The use of post detonation analysis of stable isotope ratios to determine the type and production process of the explosive involved.** McGuire, R.R.; Velsko, C.A.; Lee, C.G.; Raber, E. Lawrence Livermore National Lab., CA (United States). 5 Mar 1993. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93018497. Source: OSTI; NTIS; GPO Dep.

The detonation of a series of explosives was performed in a controlled manner to collect the resulting, solid residue or "soot." This residue was examined to determine the ratios of the stable carbon, hydrogen, and nitrogen isotopes. The goal of the experiment was to determine if these ratios could be used to indicate, from the post detonation residues, the type and origin of the detonated explosive. The ratios of the stated stable isotopes in the undetonated explosive were also determined. Despite some reservations in the quality of the data resulting from contamination by nonexplosive components, certain trends can be discerned. (1) Carbon isotopes allow aromatic explosives to be distinguished from nonaromatic explosives. This trend seems to carry through the detonation so that the distinction might be made after the fact. (2) The amination process for TATB can be detected through the hydrogen and, to some extent, the nitrogen isotope ratios. Unfortunately, the data are not sufficiently good to determine if this differential carries through the detonation. (3) The relative magnitude and sign of the nitrogen isotope ratio seems to carry through the detonation: some exchange with atmospheric nitrogen is probable. Even though this set of experiments must also be viewed as preliminary, there is a definite indication that certain qualitative characteristics of explosives can be detected after the detonation. This "signature" could have application to both intelligence and counter terrorism.

33724 (UCRL-ID–113360) **Slow cook-off test results for RX-08-FK in a toroidal composite vessel: Test Two.** von Holtz, E. (Lawrence Livermore National Lab., CA (United States)); Bretl, D.; Spingarn, J.; Ferrario, M.; Didlake, J. Lawrence Livermore National Lab., CA (United States); Sandia National Labs., Livermore, CA (United States). Feb 1993. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48 ;AC04-76DP00789. Order Number DE93017961. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A second slow cook-off test was conducted, during which a toroidal composite vessel containing 6.5 kg of RX-08-FK Paste Extrudable Explosive was subjected to a gradually increasing thermal environment of 3.3°C/hr (after an initial 8 hr soak at 74°C). This test differed from the first test in that the metal end pieces in the composite vessel were secured in place with set-screws. Ten strain gauges and five thermocouples located at various points around the toroid were used to provide data. In addition to that instrumentation, the entire test was documented with two video cameras. Post-test inspection indicated that the result of the test was an explosion, which was more violent than the previous test, and occurred after 36 hours, at an oven temperature of 165°C. Comparing the results to those of the first slow cook-off test, In which the metal end pieces were adhesively bonded into place without set screws, shows that the effect of the increasing restraint is to lower the reaction temperature by about 18°C and to slightly increase the violence of rejection. Neither observation suggests any problems with the underlying safety theme.

33725 (UCRL-ID–113364) **2,4-dinitroimidazole: A practical insensitive high explosive?.** Jayasuriya, K. (Army Research and Development Center, Dover, NJ (US)); Damauarapu, R.; Simpson, R.L.; Coon, C.L.; Coburn, M.D. Lawrence Livermore National Lab., CA (United States); Los Alamos National Lab., NM (United States). Mar 1993. 6p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-48 ;W-7405-ENG-36. Order Number DE93017962. Source: OSTI; NTIS (US Sales Only); GPO Dep.

As part of an effort to develop new explosives and propellants with enhanced properties, the authors have discovered that 2,4-dinitroimidazole (2,4-DNI) may be a good material for both applications. In regards to application as a high explosive 2,4-DNI may be a practical alternative to TNT and TATB. The requirements here are that it has performance at least as good as TNT, that it is insensitive, and that it is low cost. As is shown in this work, it appears that 2,4-DNI may meet all three of these goals. Performance measurements and thermochemical code predictions indicate that it is 15–22% more energetic than TATB in terms of metal acceleration. Calculationally it also appears that the detonation products are very hot which suggests it may be a good substitute for TNT, RDX, and HMX in composite explosive formulations. Furthermore, the preliminary measurements indicate that its safety properties are very good. Impact sensitivity of neat 2,4-DNI ranges from 100 cm to greater than 320 cm (HMX approx. 30 cm) depending on the purity of the material. The less pure material is less sensitive in a way that is not yet understood. In regards to thermal sensitivity it is superior to the nitramines. Finally, the cost of 2,4-DNI may be quite low in production.

33726 (UCRL-ID–113563) **LX-17 chemical kinetic material model for Chemical TOPAZ2D.** Hendricks, J.T. Lawrence Livermore National Lab., CA (United States). Feb 1993. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93014363. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A chemical reaction kinetic material model for Chemical TOPAZ2D has been developed for modeling burning of LX-17 high explosive. The model was developed to predict warhead thermal response when subjected to fuel and/or propellant fires. Prior to this work, material models have been unavailable for Chemical TOPAZ2D to accurately predict the thermal response of burning LX-17. Numerical results compared to George Bloom's experimental test in 1983 indicate that the burn rate and burn temperature can be simulated with excellent correlation when using, the present LX-17 material model. Numerical modeling, also have insight to the shape of the burn front and the thermal propagation. Observations indicate that a higher burn rate resulted from the experimental test over the adiabatic burn rate of LX-17. This effect was due to the thermal diffusion down the outer stainless steel can wall resulting in LX-17 preignition. The burn rate of LX-17 from George Bloom's experiment was recorded as 3.7-3.9 mm/min. Using the LX-17 material model, a one-dimensional numerical simulation indicates that the adiabatic burn rate is 2.2 mm/min. Since the burning of LX-17 within a weapon is closer to an adiabatic burn, the lower estimate for burn rate shows an enhancement in thermal protection.

33727 (UCRL-JC–112314) **The variation of the ignition temperature of solid explosives as a function of heating rate.** Creighton, J.R. Lawrence Livermore National Lab., CA (United States). 23 Apr 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9305189–5: 1993 joint Army, Navy, NASA, Air Force (JANNAF) Propulsion Systems Hazards Subcommittee meeting, Ft. Lewis, WA (United States), 10-14 May 1993). Order Number DE93017189. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report was motivated by a need to calculate the time when the high explosive in a nuclear weapon will ignite if the weapon is heated in a fire. Numerical calculations were done to determine the ignition temperature of a slab of explosive where the temperature of one surface is $T_o + \beta t$ and there is no heat flow through the other surface. Calculation were done using three models of the chemical kinetics: a single Arrhenius reaction rate, 3.5×10^{19} exp(−30,000/T), and McGuire and Tarver's simplified kinetics models for HMX (octahydro-1,3,5,7-tetranitro-1,3,5,7–tetrazocine) and TATB (2,4,6-trinitro-1,3,5-benzentriamine). The numerical results show that the ignition temperature of an explosive depends on the heating rate, β. The results can be fit by $T_{ign} = T_1/(1-b1n\beta)$ (Eq. 1) using appropriate values of the two fitting parameters, T_1 and b. Each kinetics model yields different fitting parameters. For TATB T_1 = 678 K and b = 0.068; for HMX T_1 = 559 K and b = 0.026; and for a single Arrhenius rate coefficient, T_1 = 610 K and b = 0.0274. These fits are consist with the limited relevant experimental data for TATB and HMX. A mathematical model is derived to explain this fitting function. For these boundary conditions the steady state temperature in the slab has a gradient near the heated surface that is proportional to the heating rate. An equation for the temperature

rise due to the chemical reaction shows that it is a small perturbation so long as the surface temperature is less than some critical value, T_{ign}. At temperatures above T_{ign} there is no solution for the chemical contribution to the heating rate. This is thermal runaway. Numerical results from the model agree with Eq. 1 for the case of a single Arrhenius rate coefficient. With multi-step kinetics mechanisms for HMX and TATB agreement with Eq. 1 depends on which step is chosen as rate controlling.

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Refer also to citation(s) 33008, 33014, 33131, 33376

33728 (DNA-TR–92-79) **Statistics of mass production: Technical report, January 1, 1992–March 15, 1992.** Williams, R.L. (Kaman Sciences Corp., Colorado Springs, CO (United States)); Gateley, W.Y. Defense Nuclear Agency, Alexandria, VA (United States). 1 May 1993. 65p. Sponsored by Department of Defense, Washington, DC (United States). Contract DNA-001-89-C-0080. Order Number DE93014451. Source: OSTI; NTIS.

Statistical Quality Control (SQC) is a broad term defining procedures that can be employed during production to insure that parts are produced having specified characteristics and performance. In developing complex systems of systems whose performance cannot be tested as entities, methods exist to identify components and subsystems whose failures, degradations, and variations most severely erect system level performance. Once identified, two methods may be employed to reduce or eliminate the system effects caused by such critical components - (1) design change employing such techniques as redundancy, proliferation, and spatial separation, and (2) component quality improvement. This paper summarizes the SQC methods and procedures that can be employed in mass producing electronic parts - ICs, SRAMs, buffers, capacitors, connectors - to reduce variability and insure performance to specified radiation, current, voltage, temperature, shock, and vibration levels. Producing such quality parts reduces uncertainties in performance and will aid materially in validating the survivability of components, subsystems, and systems to specified threats.

33729 (DOE/FTR–93013406) **Democratization of a society and military security conference, Moscow, Russia, June 1–4, 1992: Foreign trip report, 30 May–7 June 1992.** Hopkins, J. (Los Alamos National Lab., NM (United States)); Brown, G.S. Sandia National Labs., Albuquerque, NM (United States). 27 Aug 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93013406. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report discusses travel to Russia to attend the fourth conference organized by the Association "Armed Forces and Society." The chief spokesman and apparent leader of the Society is Maj Gen (Ret) Nikita Chaldymov. Chaldymov was a leading advocate of reform, i.e., liberalization of the Red Army prior to his retirement. He has forged contacts with a number of the Western study institutes represented in the conference and is using those contacts to promote a dialogue between the various elements of the Russian defense community and Western organizations. This report details this promotion effort.

33730 (DOE/FTR–93013717) **Travel to the UK to attend the third international conference on dense z pinches and to discuss new soft x-ray test capabilities at the Atomic Weapons Establishment: Foreign trip report, April 17–24, 1993.** Spielman, R.B. Sandia National Labs., Albuquerque, NM (United States). 26 Apr 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93013717. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This trip report describes a visit by Rick B. Spielman to the Imperial College in London, UK and to the Atomic Weapons Establishment in Aldermastron. The Third International Conference on Dense Z Pinches was sponsored by the Imperial College. This is the premier conference on Z pinches and is held every 3-4 years. A talk titled "Implosion Dynamics and Heating Mechanism of Wire Array Z Pinches." A proceedings was written as well and a copy is included in this report. The pulsed power group headed by Dr. Mike Goodman at AWE(A) was visited where the author talked about the latest pulsed power designs for soft x-ray sources and about the x-ray test capabilities of a possible new driver. Dr. Goodman talked about the status of the x-ray imaging diagnostics at AWE(A).

33731 (DOE/FTR–93015635) **Travel to United Kingdom to investigate practices and technology at the Atomic Weapons Establishments (AWE): Foreign trip report, May 10–14, 1993.** Marshall, R.P. (Battelle Pantex, Amarillo, TX (United States)); Papp, A.G.; Kenagy, C.K.; Pool, G.E.; Wieck, R.L.; Hunstad, W.J.; Hollerbach, R.R. Battelle Pantex, Amarillo, TX (United States). 9 Jun 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-91AL65030. Order Number DE93015635. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Through briefings and tours, we investigated the practices and technologies applicable to pantex, especially in the disassembly operations. The observations of the pantex team are organized around the topics of general, safety, radiation dose, tooling and facilities, and organization. These observations must be viewed in context with the process, production requirements and time restraints of Pantex and our DOE mission. Many of the AWE approaches and practices emulate those now being used in US industry and government plants. Some of them have been part of the Cell/Bay effectiveness in nuclear weapons operations.

33732 (DOE/NV/10630–T6) **Blind shaft drilling: The state of the art.** Rowe, P.A. Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (United States). 20 Apr 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-89NV10630. Order Number DE93016196. Source: OSTI; NTIS; GPO Dep.

This report discusses the "Art" of blind shaft drilling which has been in a continual state of evolution at the Nevada Test Site (NTS) since the start of underground testing in 1957. Emplacement holes for nuclear devices are still being drilled by the rotary drilling process, but almost all the hardware and systems have undergone many changes during the intervening years. Blind shaft drilling and tunnel construction technologies received increased emphasis with the signing of the LTBT in 1963.

33733 (DPST–62-200-Vol.3) **SRL history, Volume 3, E.I. DuPont de Nemours and Co., Inc.** Plant Histories. Du Pont de Nemours (E.I.) and Co., Aiken, SC (United States). Savannah River Plant. Jun 1984. 169p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-76SR00001. (SR/H–603). Order Number DE93016674. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This volume summarizes the major activities and accomplishments in Power Reactor and Fuel Technology at the Savannah River Laboratory.

33734 (KCP–613-5244) **Quality metrics for product defectiveness at KCD.** Grice, J.V. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Jul 1993. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. Order Number DE93019773. Source: OSTI; NTIS; GPO Dep.

Metrics are discussed for measuring and tracking product defectiveness at AlliedSignal Inc., Kansas City Division (KCD). Three new metrics, the metric (percent defective) that preceded the new metrics, and several alternatives are described. The new metrics, Percent Parts Accepted, Percent Parts Accepted Trouble Free, and Defects Per Million Observations, (denoted by PPA, PATF, and DPMO, respectively) were implemented for KCD-manufactured product and purchased material in November 1992. These metrics replace the percent defective metric that had been used for several years. The PPA and PATF metrics primarily measure quality performance while DPMO measures the effects of continuous improvement activities. The new metrics measure product quality in terms of product defectiveness observed only during the inspection process. The metrics were originally developed for purchased product and were adapted to manufactured product to provide a consistent set of metrics plant- wide. The new metrics provide a meaningful tool to measure the quantity of product defectiveness in terms of the customer's requirements and expectations for quality. Many valid metrics are available and all will have deficiencies.

These three metrics are among the least sensitive to problems and are easily understood. They will serve as good management tools for KCD in the foreseeable future until new flexible data systems and reporting procedures can be implemented that can provide more detailed and accurate metric computations.

33735 (LA-SUB–93-204) **Department of Energy weapons complex sizing study.** Los Alamos National Lab., NM (United States); BDM International, Inc., McLean, VA (United States). 2 Nov 1987. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93018271. Source: OSTI; NTIS; GPO Dep.

Contained in the National Defense Authorization Act for FY 1988-89 (H.R. 1748, Section 3133), is a requirement for the President to conduct a study on the nuclear weapons complex for the purpose of determining the overall size and productive capacity necessary to meet national security objectives. Based on the study, the President is directed to formulate a plan to modernize the nuclear weapons complex including actions necessary to ensure operation of facilities in a safe and environmentally acceptable manner; a schedule for implementation of the plan; and the estimated costs of implementation of the plan. The Act calls for submission of a Report to the appropriate committees of the Congress including recommendations resulting from the Study and a description of the Plan. The report is to be submitted by February 15, 1988. In contrast to the Bill, the Committee report on H.R. 1748, Section 3133, calls for both a Study and a Plan to be submitted one year later than the aforementioned report, and puts much greater stress on recommendations concerning the capability of the weapons complex to be operated in a safe and environmentally acceptable manner. Thus, the Report will be submitted by President Reagan and the Study and Plan will be submitted by a new president. This report discusses the implications of this schedule, suggests a plan of action for DOE, and summarizes possible deliverables: Predictable planning baseline; Environment, safety and health; Special nuclear material availability; Non-defense programs work; Content versus pace; Testing; Weapons research, development and testing versus production and stockpile integrity versus new builds; Integration with DOD programming cycle; Duality in research and development; and Program packaging.

33736 (SAND–91-1269) **The unique signal concept for detonation safety in nuclear weapons.** Spray, S.D.; Cooper, J.A. Sandia National Labs., Albuquerque, NM (United States). Jun 1993. 67p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018520. Source: OSTI; NTIS; GPO Dep.

The purpose of a unique signal (UQS) in a nuclear weapon system is to provide an unambiguous communication of intent to detonate from the UQS information input source device to a stronglink safety device in the weapon in a manner that is highly unlikely to be duplicated or simulated in normal environments and in a broad range of ill-defined abnormal environments. This report presents safety considerations for the design and implementation of UQSs in the context of the overall safety system.

33737 (SAND–93-0704) **Nuclear weapon reliability evaluation methodology.** Wright, D.L. (Sandia National Labs., Albuquerque, NM (United States)). Sandia National Labs., Albuquerque, NM (United States). Jun 1993. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018047. Source: OSTI; NTIS; GPO Dep.

This document provides an overview of those activities that are normally performed by Sandia National Laboratories to provide nuclear weapon reliability evaluations for the Department of Energy. These reliability evaluations are first provided as a prediction of the attainable stockpile reliability of a proposed weapon design. Stockpile reliability assessments are provided for each weapon type as the weapon is fielded and are continuously updated throughout the weapon stockpile life. The reliability predictions and assessments depend heavily on data from both laboratory simulation and actual flight tests. An important part of the methodology are the opportunities for review that occur throughout the entire process that assure a consistent approach and appropriate use of the data for reliability evaluation purposes.

33738 (UCRL-ID–114809) **Risk assessment of the arming and firing system at the Nevada Test Site.** Altenbach, T. (Lawrence Livermore National Lab., CA (United States)); Ferrell, W.; Greybeck, E. Lawrence Livermore National Lab., CA (United States). Jul 1993. 89p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93019555. Source: OSTI; NTIS; GPO Dep.

Assuring the safety of the arming and firing (A/F) system for nuclear device testing has been an important concern for many years. This study is concerned with the potential for a nuclear explosive safety incident due to some abnormal conditions, component failures, human errors, or external natural phenomena affecting the A/F system. Intentional human actions such as sabotage or terrorist subversion were excluded from this analysis. The safety incident under analysis is the explosive dispersal of plutonium from the device. The time of concern begins when the device and the A/F equipment are located physically adjacent at ground zero, until the device is fully stemmed. This time is divided into the following phases: device delivery and installation, hot dry run testing, and device insertion. The authors have produced both qualitative and quantitative results. They found that the A/F system is well designed, and operated by dedicated personnel. The continuous testing done on the system insures that the hardware will function safely and reliably to a high confidence level. Although very thorough administrative controls are followed and written checklists are well understood by experienced and knowledgeable people, the opportunity for human error to cause a detonation of the device is present. Even though several human errors are required for a safety incident, the potential for a common cause failure resulting from times such as miscommunication and confusion threatens to bypass the engineered safety redundancies and administrative controls. The authors determined that human interaction, during the hot dry run phase and the insertion phase, are the most important factors in the safety of the A/F system, followed by the threat of lightning during the insertion phase.

33739 (UCRL-JC–113334) **Site selection and containment evaluation for LLNL nuclear events.** Olsen, C.W. Lawrence Livermore National Lab., CA (United States). Jun 1993. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9309103–1: 7. symposium on containment of underground nuclear explosions, Kent, WA (United States), 15-16 Sep 1993). Order Number DE93016997. Source: OSTI; NTIS; INIS; GPO Dep.

During approximately the past decade, the site selection process at LLNL has evolved as the Test Program needs and resources have changed, containment practices have been modified, and the DOE and other regulatory agencies have become more restrictive. Throughout this period the Containment Program and the Field Operations Program at LLNL have managed a cooperative effort to improve site selection. The site selection process actually is three inter-related tasks, namely, selection of a stockpile hole for a specific nuclear test, selection of a drill site for a stockpile hole, and selection of a new drill site for a specific test. Each proposed site is carefully reviewed for known or projected geologic structure and medium properties, nearby holes, containment experience in the region, likelihood of drilling problems, programmatic need for a given depth of hole, and scheduling of Test Program events and resources. By using our data bank, our general knowledge of the Nevada Test Site (NTS) geology, and other information sources, as well as our background in drilling large diameter holes at the NTS, we have been able to optimize our use of NTS real estate and programmatic resources. The containment evaluation of a site is facilitated by considering the location before the hole is drilled. Discuss imposed restraints and our criteria and guidelines for site selection and assignment of events to specific holes, along with the factors that influence selection of a Working Point (WP) depth. Since siting and containment evaluation are strongly related, most major factors related to the containment evaluation process will also be reviewed.

33740 (UCRL-LR–108906) **Design, development and evaluation of a precision air bearing rotary table with large diameter through-hole.** Accatino, M.R. Lawrence Livermore National Lab.,

CA (United States). Nov 1991. 86p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93019117. Source: OSTI; NTIS; GPO Dep.

Thesis submitted to University of California, Davis.

A large diameter precision air bearing rotary table with a 16.0 inch diameter through-hole was designed, fabricated and tested in the course of this research. The rotary table will be used in conjunction with a specialized, computer controlled precision inspection machine being designed for the Department of Energy's (DOE) Nuclear Weapons Complex (NWC). The design process included a complete engineering analysis to predict the final performance of the rotary table, and to ensure that the rotary table meets the required accuracy of 4.0 microinches of total radial (3.5 microinches average radial) and 4.0 microinches total axial (3.5 microinches average axial) errors. The engineering analysis included structural deformation, thermal sensitivity and dynamic analyses using finite element methods in some cases, as well as other analytic solutions. Comparisons are made between predicted and tested values, which are listed in the rotary table error budget. The rotary table performed as predicted with measured axial and radial stiffnesses of 1.1E06 lbf/inch and 2.9E06 lbf/inch, respectively, as well as average radial, axial and tilt errors of 2.5 microinches, 1.5 microinches, and less than 0.05 arcseconds, respectively.

33741 (UCRL-LR–113578) **Propellants and explosives in ballistic missiles.** James, E. Lawrence Livermore National Lab., CA (United States). 15 Jul 1993. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93018914. Source: OSTI; NTIS (US Sales Only); GPO Dep.

At the time the propellants were selected for the Submarine Launched Ballistic Missile (SLBM) C-4 program, a Hazard Assessment Panel was formed and a number of safety tests were done under the direction of the panel. The high specific impulse propellants needed for target range contained as much as 50% HMX. Fears, which later were proven true, were expressed regarding the safety of these propellants. The standard hazard tests, including the Lawrence Livermore National Laboratory SUSAN, the Pantex SKID, and the Naval Ordnance Laboratory (NOL) GAP test, were done on the candidate propellants. During the time of the joint R and D efforts, important advances were made in solid propellant formulation and manufacturing technology. The behavior of the non-Chapman-Jouget (CJ) detonations of the high- energy propellants, DDT and XDT, were better recognized. Perhaps the single most important advance was the introduction of the nitrate ester polyether (NEPE) binder by JV in the propellant formulation. The most important fundamental advance was the improved understanding of the relation between constitutive properties, fracture mechanics, and threshold of initiation of reaction. For instance, LLNL, in conjunction with Stanford Research Institute (SRI), showed that ignition was induced in a NEPE first-stage propellant by spallation caused by reflection of a 0.5-GPa impact elastic wave. Combined with the improved formulations and the experimental program, the flight tests–and now fleet safety records–have produced confidence in the overall safety of current propellants. There is, however, a nagging doubt, emphasized by the Drell report, that the intrinsic ease of shock initiation of the high-energy NEPE propellants could make possible a catastrophic accident with accompanying plutonium dispersal. Such an accident would have grave consequences in our national defense stance.

33742 (WSRC-RP–93-755) **Vitrification of excess plutonium.** McKibben, J.M.; Benjamin, R.W.; Bickford, D.F.; Fernandez, L.P.; Jackson, W.N.; McDonell, W.R.; Moore, E.N.; Parks, P.B.; Plodinec, M.J.; Rajczak, W.M.; Skiles, S.K.; Wicks, G.G. Westinghouse Savannah River Co., Aiken, SC (United States). May 1993. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93018190. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The national and international interest in the disposition of excess plutonium (Pu) from dismantled nuclear weapons and other sources has grown considerably within the past year. Although a variety of disposition options have been proposed, three major options for the excess plutonium are receiving serious consideration: storing the plutonium (after minimal processing) in safeguarded vaults; using the plutonium in fuel for nuclear reactors, thus denaturing the plutonium as well as producing electricity; and vitrifying the plutonium in borosilicate glass, with or without the addition of high-level waste (HLW), for placement in safeguarded vaults and/or entombment in a deep geologic repository. The policy decision on whether to store the excess plutonium indefinitely, use/denature it in power reactors, or dispose of it in vitrified form will be influenced by a number of technical and socio-political factors. This report addresses key technical factors that would be important to the third disposition option, vitrification. No recommendation is made regarding vitrification versus the other two disposition options, or which vitrification option should be pursued if vitrification is chosen as the mode of disposition.

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33743 (BNL–49247) **Proliferation detection using a remote resonance Raman chemical sensor.** Sedlacek, A.J.; Chen, C.L.; Dougherty, D.R. Brookhaven National Lab., Upton, NY (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-930749–52: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93018847. Source: OSTI; NTIS; GPO Dep.

The authors discussed the potential of the resonance Raman chemical sensor as a remote sensor that can be used for gases, liquids or solids. This spectroscopy has the fundamental advantage that it is based on optical fingerprints that are insensitive to environmental perturbations or excitation frequency. By taking advantage of resonance enhancement, the inelastic scattering cross-section can increase anywhere from 4 to 6 orders of magnitude which translates into increased sensing range or lower detection limits. It was also shown that differential cross-sections as small as 10^{-27} cm^2/sr do not preclude the use of this technique as being an important component in one's remote-sensing arsenal. The results obtained in the early 1970s on various pollutants and the more recent work on atmospheric water cast a favorable light on the prospects for the successful development of a resonance Raman remote sensor. Currently, of the 20 CW agent-related "signature" chemicals that the authors have investigated, 18 show enhancements ranging from 3 to 6 orders of magnitude. The absolute magnitudes of the measured resonance enhanced Raman cross-sections for these 18 chemicals suggest that detection and identification of trace quantities of the "signature" chemicals, through a remote resonance Raman chemical sensor, could be achieved.

33744 (SAND–93-1696) **Evaluation of the Deployable Seismic Verification System at the Pinedale Seismic Research Facility.** Carr, D.B. Sandia National Labs., Albuquerque, NM (United States). Aug 1993. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93040212. Source: OSTI; NTIS; GPO Dep.

The intent of this report is to examine the performance of the Deployable Seismic Verification System (DSVS) developed by the Department of Energy (DOE) through its national laboratories to support monitoring of underground nuclear test treaties. A DSVS was installed at the Pinedale Seismic Research Facility (PSRF) near Boulder, Wyoming during 1991 and 1992. This includes a description of the system and the deployment site. System performance was studied by looking at four areas: system noise, seismic response, state of health (SOH) and operational capabilities.

33745 (UCRL-ID–113780) **On-site inspection: A brief overview and bibliography of techniques pertinent to assessing suspected nuclear test sites.** Carrigan, C.R. Lawrence Livermore National Lab., CA (United States). Mar 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93019583. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this report is to provide a brief overview and bibliography of those techniques that may have application for the evaluation of a site to determine if a high energy release event is nuclear in nature. This effort is motivated by recognition of the changing world political climate and the perception that low yield

and non-proliferation issues will grow in importance as countries become increasingly involved as signators to treaties that are intended to limit the development and testing of nuclear weapons. Along with an increasing interest in such issues is the awareness of the need to implement improved capabilities for treaty monitoring programs that must deal with assessing suspicious occurrences of high energy release events. In preparing this report, it is recognized that monitoring can take two main forms. The first involves the resolution of unidentified events detected by seismic and satellite National Technical Means. Events of an indeterminate nature could occur world-wide and could induce tension in neighboring countries. If an on-site measurement capability were available, a monitoring team could be sent to the suspected site of an event to take measurements that could confirm or disprove the occurrence of a clandestine nuclear test. The second monitoring form is the confirmation that a clandestine event is not masked by a declared event. For example, a large mining explosion could mask a decoupled nuclear explosion. On-site measurements before and during the test could confirm that a clandestine event did not occur and could provide assurance that the party carrying out the explosion is not taking advantage of clandestine testing opportunities. 48 refs.

4504 Nuclear and Radiological Warfare

33746 (UCRL-ID–113660) **Effectiveness of nuclear interceptors against large single volume chemical/biological warheads.** Mendelsohn, E. Lawrence Livermore National Lab., CA (United States). Jan 1993. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93017946. Source: OSTI; NTIS; GPO Dep.

In a continuing series of calculations which explore potential nuclear defenses against chemical and/or bacteriological warheads the author has now completed a study in which he postulated a large canister geometry. Instead of looking at a collection of smaller submunitions as done previously, he has now one single large volume of Sarin (a nerve agent). This is a more stressing case for nuclear defense, in that neutrons must traverse a long path in the hydrogenous solution if they are to deposit their energy in the region of Sarin farthest from the source. The author presents results from Monte Carlo calculations which indicate that differences in energy deposition between Sarin regions close to the source and those farthest from the source have increased very significantly.

4505 Strategic Defense Initiative

Refer also to citation(s) 33995, 33996

33747 (SAND–93-0402C) **Calculations supporting HyperVelocity Launcher development.** Trucano, T.G.; Chhabildas, L.C. Sandia National Labs., Albuquerque, NM (United States). 1993. 4p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930676–25: 14. international conference of the International Association for the Advancement of High Pressure Science and Technology, Colorado Springs, CO (United States), 27 Jun - 2 jul 1993). Order Number DE93018835. Source: OSTI; NTIS; GPO Dep.

Sandia National Laboratories has developed a HyperVelocity Launcher (also referred to as HVL) in which a thin flier plate (nominally 1 mm thick) is launched to velocities in excess of 12 km/s. The length to diameter ratio of these launched flier plates varies from 0.02 to 0.06. The launch technique is based upon using structured, time-dependant, high-pressure, high-acceleration pulses to drive the flier plates. Such pulses are achieved by using a graded-density material to impact a stationary flier. A computational and experimental program at Sandia seeks to extend this technique to allow launching thick plates whose length-to-diameter ratio is 10 to 20 times larger than thin plates. Hydrodynamic codes are used to design modifications to the basic technique. The authors have controlled and used these effects to successfully launch a chunk-flier, consisting of 0.33 gm of titanium alloy, 0.3 cm thick by 0.6 cm in diameter, to a velocity of 10.2 km/s. This is the largest chunky size ever launched at this velocity from a gas gun configuration.

4506 Chemical and Biological

Refer also to citation(s) 33140, 33746

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Refer also to citation(s) 32539

33748 (DOE/RL–93-42) **1992 Toxic Chemical Release Inventory: Emergency Planning and Community Right-To-Know-Act of 1986 Section 313.** USDOE Richland Operations Office, WA (United States). Jul 1993. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018730. Source: OSTI; NTIS; INIS; GPO Dep.

Section 313 of the Emergency Planning and Community Right-To-Know Act of 1986 (EPCRA) requires the annual submittal of toxic chemical release information to the US Environmental Protection Agency (EPA). The following document is the July 1993 submittal of the EPCRA Toxic Chemical Release Inventory Report (Form R). Included is a Form R for chlorine and for lead, the two chemicals used in excess of the established regulatory thresholds at the Hanford Site by the US Department of Energy, Richland Operations Office and its contractors during calendar year 1992.

5401 Environmental Sciences, Atmospheric

Refer also to citation(s) 32200, 32213, 32307, 32367, 32388, 32389, 32393, 32535, 32536, 32538, 32552, 32570, 32575, 32635, 32637, 32646, 32669, 32775, 32913, 32999, 33000, 33061, 33097, 33098, 33099, 33101, 33811, 34658, 34702

33749 (ADEME–91-01-DOC-1, pp. 81-92) **Transports and air pollution in towns.** Morcheoine, A. Agence de l'Environnement et de la Maitrise de l'Energie, 75 - Paris (France). 1991. (In French). (CONF-9111328–: Colloquium on biomass: an energy source for the quality of environment, Paris (France), 27-28 Nov 1991). In *Biomass: an energy source for the quality of environment.* 245p. Order Number DE94700004. Source: OSTI; NTIS (US Sales Only).

Transportation is assumed to be nowadays, as industrial and heating pollutions are lessened and traffic has largely increased, the main cause for air pollution in cities. The various types of pollution causes from transportation are reviewed: gaseous pollutants (CO, NOx, ...) emitted by the engine combustion, pollutants due to fuel composition (Pb, sulfur, ...); air pollution control and abatement may be achieved by various means such as municipal traffic limitations, district planning, vehicle regulations (anti-pollution controls, fuel quality, engine characteristics and control, ...), air quality control, fuel substitution incentives (bio-fuels). The european regulations are discussed.

33750 (ANL/CMT-ACL/CP–77718) **On-line monitoring of incinerator emissions.** Mao, Zhuoxiong; Demirgian, J.C.; Hwang, E. Argonne National Lab., IL (United States). [1993]. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930572–8: 12. annual international symposium on thermal treatment technologies - incineration conference, Knoxville, TN (United States), 3-7 May 1993). Order Number DE93017406. Source: OSTI; NTIS; INIS; GPO Dep.

As part of efforts to develop an on-line emissions monitor to detect specific organic compounds for incinerators, the authors tested a Fourier transform infrared spectrometer (FTIR) coupled with a long-path cell (LPC). A mixture of toluene, chlorobenzene, 1,1,1-trichloroethane, and trichloroethylene with elemental ratio C:H:Cl = 3:3.1:0.9 was incinerated in a methane/air flame. The effluent was continuously passed through a heated long-path cell. Eleven target compounds were simultaneously analyzed: methane, toluene, chlorobenzene, 1,1,1-trichloroethane, trichloroethylene, benzene, ethylene, hydrogen chloride, carbon monoxide, carbon dioxide, and water. During the testing, the incinerator temperature and the excess air ratio were deliberately changed to simulate both complete and incomplete combustion conditions in the incinerator. Test results indicate that the FTIR/LPC system can successfully follow concentration changes in the emissions that are associated with the change in the incinerator operations. In addition to carbon monoxide, methane, ethylene, and benzene have been found to be

major products of incomplete combustion of the mixture. In this paper, the authors also discuss problems related to obtaining representative calibration standards and to developing adequate methods for continuous monitoring of emissions.

33751 (ANL/ER/CP–80321) **Organic carbonyl compounds in Albuquerque, New Mexico, air: A preliminary study of the effects of oxygenated fuel use.** Popp, C.J. (New Mexico Inst. of Mining and Technology, Socorro, NM (United States). Dept. of Chemistry); Zhang, Lin; Gaffney, J.S. Argonne National Lab., IL (United States); New Mexico Inst. of Mining and Technology, Socorro, NM (United States). Dept. of Chemistry. Jun 1993. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9303207–1: Symposium on alternative fuels and the environment, Ann Arbor, MI (United States), 28 Mar - 2 apr 1993). Order Number DE93017748. Source: OSTI; NTIS; GPO Dep.

A suite of inorganic and organic species were analyzed for four 2–4 day time periods over a year in Albuquerque, New Mexico to determine baseline conditions for organic pollutants under the current air pollution control parameters. Concentrations of low molecular weight carbonyl compounds were relatively high compared with areas such as Los Angeles. Formio acid concentrations in air samples were significant even in winter. In addition, ratios of peroxypropionyl nitrate to peroxyacyetyl nitrate are higher than expected and may be related to the use of oxygenated fuels which are used to mitigate CO concentrations. The number of CO violations in Albuquerque has decreased steadily since 1982 and the downward trend has continued since 1989 when oxygenated fuel use was mandated. It is, therefore, difficult to correlate the drop in CO violations directly to the use of oxygenated fuels when such factors as fleet turnover, woodburning controls, emissions testing and meteorological conditions also may be playing significant roles. More detailed studies are needed to determine the specific relationship between the use of oxygenated fuels and the air quality in Albuquerque, New Mexico and similar urban areas in the western United States.

33752 (ANL/ES/CP–80079) **A comparison of wet and dry scrubbing systems for control of metals and dioxin/furan emissions from incinerators.** Farber, P.S.; Huang, H.S. Argonne National Lab., IL (United States). [1993]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930364–6: Spring national meeting of the American Institute of Chemical Engineers, Houston, TX (United States), 28 Mar - 1 apr 1993). Order Number DE93017446. Source: OSTI; NTIS; GPO Dep.

In Europe and the United States, both wet and dry (including semidry) scrubbing systems are being used for control of emissions from all types of waste incinerators. In terms of the effectiveness of controlling particulates and acid gases, both types of scrubbing systems are capable of meeting US Environmental Protection Agency and European Community limits. Two of the more difficult emissions requirements for an incinerator air-pollution-control system to meet are the metals and the dioxin/furan limits. The dioxin/furan emissions requirement is especially stringent, calling for levels below 1 ng (10^{-9}) per cubic meter toxic equivalency. The differences between wet and dry scrubbing systems are discussed in this paper, as well as the advantages and disadvantages of each in its application to the control of emissions from incinerators. Particular attention will be paid to control of metals and dioxin/furan emissions and to the sampling and analysis techniques used to measure these emissions. Toxic equivalency factors will be explained, and in particular, the international toxic equivalency factor proposed as the US and European standard will be discussed. This paper will also address some of the techniques being employed to minimize the emissions of toxic compounds and discuss the use of combined wet and dry scrubbing systems for increased assurance of compliance.

33753 (BNL–49134) **Energy development and CO_2 emissions in China.** Xiaolin Xi (Carnegie-Mellon Univ., Pittsburgh, PA (United States)). Brookhaven National Lab., Upton, NY (United States). Mar 1993. 287p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE93018385. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this research is to provide a better understanding of future Chinese energy development and CO_2 emissions from burning fossil fuels. This study examines the current Chinese energy system, estimates CO_2 emissions from burning fossil fuels and projects future energy use and resulting CO_2 emissions up to the year of 2050. Based on the results of the study, development strategies are proposed and policy implications are explored. This study first develops a Base scenario projection of the Chinese energy development based upon a sectoral analysis. The Base scenario represents a likely situation of future development, but many alternatives are possible. To explore this range of alternatives, a systematic uncertainty analysis is performed. The Base scenario also represents an extrapolation of current policies and social and economic trends. As such, it is not necessarily the economically optimal future course for Chinese energy development. To explore this issue, an optimization analysis is performed. For further understanding of developing Chinese energy system and reducing CO_2 emissions, a Chinese energy system model with 84 supply and demand technologies has been constructed in MARKAL, a computer LP optimization program for energy systems. Using this model, various technological options and economic aspects of energy development and CO_2 emissions reduction in China during the 1985-2020 period are examined.

33754 (BNL–49283) **Identification of source contributions to visibility-reducing organic aerosols in the vicinity of Grand Canyon National Park: Interim final report.** Mazurek, M.A. (Brookhaven National Lab., Upton, NY (United States)); Hallock, K.A.; Leach, M.; Mason-Jones, M.; Mason-Jones, H.; Salmon, L.G.; Winner, D.A.; Cass, G.R. Brookhaven National Lab., Upton, NY (United States); California Inst. of Tech., Pasadena, CA (United States). Dept. of Environmental Engineering Science. Jun 1993. 130p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Contract CX-0001-8-0017. Order Number DE93018815. Source: OSTI; NTIS; GPO Dep.

Sulfates and carbonaceous aerosols are the largest contributors to the fine particle burden in the atmosphere near Grand Canyon National Park. While the effects of sulfate particles on visibility at the Grand Canyon has been extensively studied, much less is known about the nature and origin of the carbonaceous aerosols that are present. This disparity in understanding arises from at least two causes: aerosol carbon data for the region are less plentiful and many of the sources that could contribute to that organic aerosol are both diverse and not well characterized. The objective of this present study is to examine the origin of the carbonaceous aerosol at Grand Canyon National Park during the summer season based on molecular tracer techniques applied to source and ambient samples collected specifically for this purpose.

33755 (BNL–70341) **[Travel to England to participate in a symposium on carbon dioxide mitigation technologies]: Foreign trip report, March 23, 1993–April 1, 1993.** Steinberg, M. Brookhaven National Lab., Upton, NY (United States). 2 Apr 1993. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE93014798. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The traveler participated in the International Energy Agency (IEA) Carbon Dioxide Disposal Symposium, held at Christ Church College, Oxford, England during March 29–31, 1993. The title of presented paper, coauthored with Dr. Robert Borqwardt of the USEPA and Air Energy Engineering Laboratory (AEERL), in Research Triangle Park, North Carolina, and Dr. Yuanji Dong of the Hydrocarb Corporation in New York, NY, was "The Coprocessing of Fossil Fuels and Biomass for $C0_2$ Emission Reduction in the Transportation Sector." This meeting was a major international meeting bringing together technology developers from around the world to exchange information on global greenhouse $C0_2$ mitigation technologies. There were 230 registrants from 28 countries. A review of each session is given in this report.

33756 (CONF-9306207–1) **An interim protocol for the mitigation of radon in nonresidential buildings.** Wilson, D.L.; Dudney, C.S.; Gammage, R.B. Oak Ridge National Lab., TN (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 1. international workshop on indoor radon remedial action; Rimini

(Italy); 27 Jun - 2 jul 1993. Order Number DE93017855. Source: OSTI; NTIS; INIS; GPO Dep.

To date, the US Environmental Protection Agency has not published guidance for radon testing, diagnostics, or mitigation within large, nonresidential buildings. Current research indicates that large buildings may contain construction features or mechanical systems that could inhibit the installation or operation of a mitigation system. Health and safety issues such as asbestos and fire codes may further interfere with the installation process. Studies also show that elevated radon can be restricted to a particular area or room within a building and not be uniformly distributed. A four-step, sequential protocol has been developed to address these issues and facilitate large building radon mitigation.

33757 (DOE/FTR–93014810) **Travel to Japan to witness current proof-of-concept testing activities and perform a quality surveillance on the laboratory procedures: Foreign trip report, February 6–16, 1992.** Noble, J.J.; Kelly, J.W. Westinghouse Hanford Co., Richland, WA (United States). 16 Mar 1992. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93014810. Source: OSTI; NTIS (US Sales Only); GPO Dep.

In November 1991, Kaiser Engineers Hanford Company (KEH) awarded contract KEH-5232 (C-018H) to JGC Corporation of Tokyo, Japan, for the design and construction of the Effluent Treatment Facility (ETF), Project C-018H. The contractor's schedule for Basic Engineering (30%) indicated all basic engineering, Proof of Concept testing and development of the process would be performed in their Yokohama and Oarai, Japan, facilities during the period January through April, 1992. The C-018H Integrated Management Team (IMT) determined that it was necessary to perform a progress assessment of the Basic Engineering and Proof of Concept Testing in February 1992, to assure the design and testing were proceeding according to schedule and within the parameters of the contract specification. In addition, and in support of this assessment, a Quality surveillance was planned.

33758 (DOE/FTR–93015191) **The international operation workshop for the tropical oceans-global atmosphere coupled ocean-atmosphere response experiment in Australia: Foreign trip report, March 6–17, 1993.** Renne, D.S. National Renewable Energy Lab., Golden, CO (United States). 12 Apr 1992. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE93015191. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of this trip was to participate in the International Operations Workshop for the Tropical Oceans-Global Atmosphere Coupled Ocean-Atmosphere Response Experiment (TOGA COARE) in Townsville, Australia, March 8–13, 1992 (this participation was essential to assure proper coordination between DOE's Atmospheric Radiation Measurement (ARM) Program and TOGA COARE activities); to meet with representatives of the Department of Meteorology, University of Hawaii, on ARM's Tropical Western Pacific activities.

33759 (DOE/FTR–93015193) **Travel to Austria to attend meeting on modelling of radionuclide transfer in terrestrial, aquatic and urban environments: Foreign trip report, February 28–March 13, 1992.** Templeton, W.L. Pacific Northwest Lab., Richland, WA (United States). 7 Apr 1992. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93015193. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of this travel was to attend as, (a) Chairman of the Coordinated Research Program (CRP) on the "Validation of Models for the Transfer of Radionuclides in Terrestrial, Aquatic and Urban Environments," (VAMP) from March 2–6, 1992, and as, (b) a participant in the newly formed Rivers Working Group.

33760 (DOE/FTR–93015637) **Travel to Papua New Guinea to shut down the Pilot Radiation Observation Experiment (PROBE): Foreign trip report, May 7–19, 1993.** Renne, D.S. National Renewable Energy Lab., Golden, CO (United States). 17 Jun 1993. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE93015637. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Since 1 November, 1992, the DOE Atmospheric Radiation Measurement Program (ARM) has been conducting a campaign-style clouds and radiation measurement experiment, called the Pilot Radiation Observation Experiment (PROBE), in Kavieng, Papua New Guinea. This experiment has been conducted in conjunction with the multi-national Tropical Oceans-Global Atmosphere Coupled Ocean-Atmosphere Response Experiment (TOGA COARE), which ran from 1 November 1992–28 February, 1993. I have worked with Dr. William Clements of Los Alamos National Laboratory (ARM's Tropical Western Pacific Site Program Manager) and Dr. Tool Ackerman of Pennsylvania State University (ARM'S Site Scientist for the Tropical Western Pacific) on this experiment, and provided coordination between ARM's activities and the larger TOGA COARE field study. In Kavieng, PROBE assumed operational responsibility of an Integrated Sounding System (ISS), which was installed in support of TOGA COARE. In a previous trip report, dated 7 December 1992, the installation of PROBE and the ISS was described. A follow-up visit to the site was described in a trip report dated 8 February, 1993. This report describes the visit that George Valero, a graduate student at Penn State University, and I took to the site to shut down the experiment, pack the equipment, and arrange for shipment of the PROBE seacontainer to the US. I also visited with officials of the PNG National Weather Service and Department of Civil Aviation in Port Moresby, whose assistance in this experiment was extremely helpful. As part of our planning for ARM's future work in the Tropical Western Pacific, I visited the solar radiation laboratory of the Bureau of Meteorology in Melbourne on my return to the US.

33761 (DOE/FTR–93017254) **Travel to France for meeting on cloud and radiation budget studies: Foreign trip report, May 8–15, 1992.** Spaeth, W.T. Jr. Battelle Washington Operations, DC (United States). 15 Jun 1992. 155p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93017254. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of the travel was to represent and present a status report on the Department of Energy's (DOE) Atmospheric Radiation Measurement (ARM) program, and in particular, the ARM Data Management System, to the Ninth Session of the International Satellite Cloud Climatology Program (ISCCP) Working Group on Data Management. The Agenda for the Meeting is included.

33762 (DOE/FTR–93017327) **Travel to Papua New Guinea to apprise weather officials of planned activities of the Pilot Radiation Observation Experiment (PROBE): Foreign trip report, May 1–10, 1992.** Renne, D.S. National Renewable Energy Lab., Golden, CO (United States). 26 May 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE93017327. Source: OSTI; NTIS (US Sales Only); GPO Dep.

TOGA COARE will be conducted in the Tropical Western Pacific Ocean near Papua New Guinea and the Solomon Islands from November 1992 through February 1993. During this time, the DOE Atmospheric Radiation Measurement Program (ARM) will conduct a campaign-style radiation measurement experiment, called the Pilot Radiation Observation Experiment (PROBE). I work with Dr. William Clements of Los Alamos National Laboratory (ARM's Tropical Western Pacific Site Program Manager) and Dr. Tom Ackerman of Pennsylvania State University (ARM'S Site Scientist for the Tropical Western Pacific) on this experiment, and provide coordination between ARM's activities and the larger TOGA COARE activity. Specifically, PROBE plans to assume the operation of an Integrated Sounding System (ISS), to be installed at Kavieng, New Ireland Province, in Papua New Guinea (PNG). PROBE will enhance the radiation measurements obtained by the Integrated Sounding System, and install other radiometric and cloud remote sensing equipment at the site. A visit to the site prior to the actual experiment was necessary to make final logistical arrangements for the equipment and personnel involved in the ISS and PROBE. The visit was timed to be coordinated with a visit by personnel from that National Oceanic and Atmospheric Administration (NOAA) and the National Center for Atmospheric Research (NCAR) involved in the design and installation of the ISS. In addition, we were joined by Dr. Joerg Hacker of Flinders University, Australia, who will base

a Cessna 340 research aircraft at Kavieng during TOGA COARE, and by representatives of the PNG Weather Service. Prior to the site visit, Dr. Hacker and I met with the head of the PNG Weather Service in Boroko. Following the site visit, I travelled to Manus Island to observe the operation of an ISS that had just been installed there by the NOAA and NCAR team.

33763 (DOE/MC/29116–3406) **Novel mass spectrometric instrument for gaseous and particulate characterization and monitoring: Technical progress report, January 1, 1993–March 31, 1993.** Coggiola, M.J. SRI International, Menlo Park, CA (United States). Apr 1993. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC29116. Order Number DE93019992. Source: OSTI; NTIS; INIS; GPO Dep.

Under contract DE-AC21-92MC29116, SRI International will develop a unique new instrument that will be capable of providing real-time (<I minute), quantitative, chemical characterization of gaseous and particulate pollutants generated from DOE waste cleanup activities. The instrument will be capable of detecting and identifying volatile organic compounds, polynuclear aromatic hydrocarbons, heavy metals, and transuranic species released during waste cleanup activities. The instrument will be unique in its ability to detect and quantify in real-time these diverse pollutants in both vapor and particulate form. The instrument to be developed under this program will consist of several major components: (1) an isokinetic sampler capable of operating over a wide range of temperatures (up to 500 K) and flow rates; (2) a high pressure to low pressure transition and sampling region that efficiently separates particles from vapor-phase components for separate, parallel analyses; (3) two small mass spectrometers, one optimized for organic analysis using a unique field ionization source and one optimized for particulate characterization using thermal pyrolysis and electron-impact ionization (EI); and (4) a powerful personal computer for control and data acquisition.

33764 (DOE/PC/88858–T11) **[Surface study of absorbents for the removal of SO_x and NO_x]: Quarterly report, June 1, 1990–August 31, 1990.** Cooper, B.R.; Montano, P. West Virginia Univ., Morgantown, WV (United States). Dept. of Physics. [1990]. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-88PC88858. Order Number DE93019440. Source: OSTI; NTIS; GPO Dep.

XANES and EXAFS measurements were made on a CuO/Al_2O_3 sample which went through a complete reaction cycle with flue gases, followed by comparison with pure CuO. In the modeling studies, of the possible bridging type adsorption configurations for the SO_2 molecule on CuO/Al_2O_3, the only one yielding SO_2 adsorption of possible practical interest is that for the SO_2 molecule bridging a Cu and an Al atom with the molecule bent away from the surface; the bonding energy is 1.66 eV.

33765 (DOE/PC/88858–T12) **[Surface study of absorbents for the removal of SO_x and NO_x]: Quarterly report, September 1, 1990–November 30, 1990.** Cooper, B.R.; Montano, P. West Virginia Univ., Morgantown, WV (United States). Dept. of Physics. [1990]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-88PC88858. Order Number DE93019400. Source: OSTI; NTIS; GPO Dep.

XANES spectra are given for a number of model sulfur-containing compounds. The XANES and EXAFS spectra and structures of the inorganic standards ($CuSO_4$, FeS_2, FeS, CuS) are discussed. Calculations were made on SO_2 adsorption on CuO/Al_2O_3 surface; results show that the SO_2 is adsorbed on the surface via O-Cu bonding, probably in the form of a "bridge" with the two oxygen atoms of SO_2sitting at two surface metal atoms. It is probably better to have low-temperature adsorption in reusable adsorbents because of the lower bonding energy of the O-Cu bonding. The possibility of adsorption at the edge or corner of the material is considered.

33766 (EML–556) **Semi-annual report of the Department of Energy, Office of Environmental Restoration and Waste Management, Quality Assessment Program.** Sanderson, C.G.; Klusek, C.S. Department of Energy, New York, NY (United States). Environmental Measurements Lab. 1 Jul 1993. 170p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93019732. Source: OSTI; NTIS; INIS; GPO Dep.

This Quality Assessment Program (QAP) is designed to test the quality of the environmental measurements being reported to the Department of Energy by its contractors. Since 1976, real or synthetic environmental samples that have been prepared and thoroughly analyzed at the Environmental Measurements Laboratory (EML) have been distributed at first quarterly and then semi-annually to these contractors. Their results, which are returned to EML within 90 days, are compiled with EML's results and are reported back to the participating contractors 30 days later. A summary of the reported results is available to the participants 3 days after the reporting deadline via a modem-telephone connection to the EML computer. This report presents the results from the analysis of the 38th set of environmental quality assessment samples (QAP XXXVIII) that were received on or before June 2, 1993.

33767 (ENEA-RT-NUCL–92-01) **X-ray fluorescence for heavy metals determination in suspended particulate samples: Feasibility study.** Aparo, M. (ENEA, Casaccia (Italy). Area Nucleare); Zeppa, P.; Lombardi, V.; Ferrandino, G.; Schirippa Spagnolo, G. May 1992. 54p. (In Italian). (RT/NUCL–92-01). Order Number DE93522944. Source: OSTI; NTIS (US Sales Only).

The activities described in this report were carried out in the framework of the collaboration contract between ENEA (Italian Agency for Energy, New Technologies and the Environment) (COMB-MEPIS Division) and ELECOS S.p.A. The aim of this work was to carry out a feasibility study on the use of the X-ray fluorescence technique for the determination of the air dispersed lead particles collected on a microporous filter. Measurement instrument set-up, relying on either a solid state detector or proportional counter, were considered and a measuring head using an Am^241 radioisotopic source was designed.

33768 (INIS-JP–008, pp. 492-495) **Environmental monitoring of molecular tritium.** Ichimasa, M. (Ibaraki Univ., Mito (Japan). Faculty of Science); Ichimasa, Y.; Akita, Y.; Suzuki, M.; Obayashi, H.; Sakuma, Y. Japan Atomic Energy Research Inst., Tokyo (Japan). 1992. 558p. (CONF-9203223–: International conference on radiation effects and protection, Mito (Japan), 18-20 Mar 1992). In *Proceedings of the international conference on radiation effects and protection.* Order Number DE93764166. Source: OSTI; NTIS; INIS.

The oxidation of atmospheric molecular tritium (HT) in vegetation was determined by in vitro experiments for various kinds of woody and herbaceous plant leaves, mosses and lichens taken from a forest and a garden in Ibaraki prefecture and a forest in Gifu prefecture, and comparison of the HT oxidation activity in vegetation was made with those in its neighboring surface soil (0-5cm in depth). The oxidation of HT in woody plant leaves was extremely low, only about 1/10000-1/1000 that in the surface soil as well as herbaceous plant leaves with some exception, whereas HT oxidation in mosses and lichens was 50-500 times that in pine needles. These results suggest the usefulness of mosses and lichens as monitor vegetation for accidental release of HT into the environment. (author).

33769 (LA–12571-C) **Proceedings for air quality management programs: A workshop on lessons learned.** Streit, G.E. (comp.). Los Alamos National Lab., NM (United States). Jun 1993. 134p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9110496–: Air quality management programs: a workshop on lessons learned, Morelos (Mexico), 16-19 Oct 1991). Order Number DE93015865. Source: OSTI; NTIS; INIS; GPO Dep.

The coordinators of this project at Los Alamos National Laboratory and the Instituto Mexicano del Petroleo proposed a workshop to bring together an international group of experts to present both the lessons of history and the current practices in air quality management around the world. The workshop would also serve as a forum for presenting the accomplishments and plans of this project and for receiving comments from the assembled group. The workshop was favored with an outstanding set of speakers who represented a broad spectrum of experience. Their papers are presented in this volume. The total attendance was forty-four (see List

of Participants) with representation from numerous interested Mexican institutions. Individual reports are processed separately for the database.

33770 (LA-UR–93-1815) **Direct Monte Carlo simulation of the chemical equilibrium composition of detonation products.** Shaw, M.S. Los Alamos National Lab., NM (United States). [1993]. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930713–13: 10. detonation symposium, Boston, MA (United States), 12-16 Jul 1993). Order Number DE93014559. Source: OSTI; NTIS; GPO Dep.

A new Monte Carlo simulation method has been developed by the author which gives the equilibrium chemical composition of a molecular fluid directly. The usual NPT ensemble (isothermal-isobaric) is implemented with N being the number of atoms instead of molecules. Changes in chemical composition are treated as correlated spatial moves of atoms. Given the interaction potentials between molecular products, "exact" EOS points including the equilibrium chemical composition can be determined from the simulations. This method is applied to detonation products at conditions in the region near the Chapman- Jouget state. For the example of NO, it is shown that the CJ detonation velocity can be determined to a few meters per second. A rather small change in cross potentials is shown to shift the chemical equilibrium and the CJ conditions significantly.

33771 (LA-UR–93-2921) **Final report of the Mexico City 1991 lidar measurements campaign.** Quick, C.R. Jr.; Archuleta, F.L.; Hof, D.E.; Karl, R.R. Jr.; Tiee, J.J.; Eichinger, W.E.; Holtkamp, D.B.; Tellier, L.L. Los Alamos National Lab., NM (United States). [1993]. 171p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93019960. Source: OSTI; NTIS; GPO Dep.

Over the last two decades, Mexico City, like many large industrial and populous urban areas, has developed a serious air pollution problem, especially during the winter months when there are frequent temperature inversions and weak winds. The deterioration in air quality is the result of several factors. The basin within which Mexico City lies is Mexico's center of political, administrative and economic activity, generating 34% of the cross domestic product and 42% of the industrial revenue, and supporting a population which is rapidly approaching the 20 minion mark. The basin is surrounded by mountains on three sides which inhibit rapid dispersal of pollutants. Emissions from the transportation fleet (more than 3 million vehicles) are one of the primary pollution sources, and are mostly uncontrolled. Catalytic converters are just now being introduced into the fleet. The Mexico City Air Quality Research Initiative is an international collaborative project between the Los Alamos National Laboratory and the Mexican Petroleum Institute dedicated to the investigation of the air quality problem in Mexico City. The main objective of the project is to identify and assess the cost and benefits of major options being proposed to improve the air quality.

33772 (LBL–33442) **Indoor Environment Program: 1992 Annual Report.** Daisey, J.M. Lawrence Berkeley Lab., CA (United States). Jun 1993. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93018601. Source: OSTI; NTIS; INIS; GPO Dep.

This paper reports progress during the year 1992 in the Indoor Environment Program in the Energy and Environment Division of Lawrence Berkeley Laboratory. Studies in the following areas are reported: energy performance and ventilation in buildings; physical and chemical characterization of indoor air pollutants; indoor radon; indoor air quality; exposure to indoor air pollutants and risk analysis. Pollutants of particular interest include: radon; volatile, semi-volatile and particulate organic compounds; and combustion emissions including environmental tobacco smoke, carbon monoxide, and nitrogen oxides.

33773 (LBL–33445) **Environmental research program: 1992 annual report.** Lawrence Berkeley Lab., CA (United States). Jul 1993. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93019101. Source: OSTI; NTIS; GPO Dep.

The objective of the Environmental Research Program is to contribute to the understanding of the formation, mitigation, transport, transformation, and ecological effects of energy-related pollutants on the environment. The program is multidisciplinary and includes fundamental and applied research in chemistry, physics, biology, engineering, and ecology. The program undertakes research and development in efficient and environmentally benign combustion, pollution abatement and destruction, and novel methods of detection and analysis of criteria and non-criteria pollutants. This diverse group investigates combustion, atmospheric processes, flue-gas chemistry, and ecological systems.

33774 (LBL–34297) **Crossed molecular beam studies of atmospheric chemical reaction dynamics.** Zhang, Jingsong. Lawrence Berkeley Lab., CA (United States). Apr 1993. 223p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93019246. Source: OSTI; NTIS; GPO Dep.

The dynamics of several elementary chemical reactions that are important in atmospheric chemistry are investigated. The reactive scattering of ground state chlorine or bromine atoms with ozone molecules and ground state chlorine atoms with nitrogen dioxide molecules is studied using a crossed molecular beams apparatus with a rotatable mass spectrometer detector. The $Cl + O_3 \rightarrow ClO + O_2$ reaction has been studied at four collision energies ranging from 6 kcal/mole to 32 kcal/mole. The derived product center-of-mass angular and translational energy distributions show that the reaction has a direct reaction mechanism and that there is a strong repulsion on the exit channel. The ClO product is sideways and forward scattered with respect to the Cl atom, and the translational energy release is large. The Cl atom is most likely to attack the terminal oxygen atom of the ozone molecule. The $Br + O_3 \rightarrow ClO + O_2$ reaction has been studied at five collision energies ranging from 5 kcal/mole to 26 kcal/mole. The derived product center-of-mass angular and translational energy distributions are quite similar to those in the $Cl + O_3$ reaction. The $Br + O_3$ reaction has a direct reaction mechanism similar to that of the $Cl + O_3$ reaction. The electronic structure of the ozone molecule seems to play the central role in determining the reaction mechanism in atomic radical reactions with the ozone molecule. The $Cl + NO_2 \rightarrow ClO + NO$ reaction has been studied at three collision energies ranging from 10.6 kcal/mole to 22.4 kcal/mole. The center-of-mass angular distribution has some forward-backward symmetry, and the product translational energy release is quite large. The reaction proceeds through a short-lived complex whose lifetime is less than one rotational period. The experimental results seem to show that the Cl atom mainly attacks the oxygen atom instead of the nitrogen atom of the NO_2 molecule.

33775 (NEI-DK–1264) **Reburning rich-lean kinetics: Annual report 1992.** Glarborg, P. (Department of Chemical Engineering, Technical University of Denmark (Denmark)); Dam-Johansen, K.; Kristensen, P.G. Nordisk Gasteknisk Center, Hoersholm (Denmark). Jun 1993. 14p. Contract GRI-5091-260-2126;Contract NGC-89-03-11. Order Number DE93525254. Source: OSTI; NTIS.

Prepared for Gas Research Institute, Chicago, Illinois, USA.

The report presents the results of the second year of a three year effort to identify optimum conditions for conversion of reactive nitrogen to N_2 at the rich-lean transition in staged combustion. The information gained will be useful for outlining improved staged combustion strategies for control of nitrogen oxides emission. Specifically, the results will be valuable for optimizing natural gas reburning and advanced reburning techniques. The experimental work is conducted in specially designed laminar flow quartz reactors that provide well-defined reaction conditions in the temperature range of interest. During the past year a parametric study of the burnout zone nitrogen chemistry in Natural Gas Reburning has been initiated. The effect of temperature, partitioning of HCN, No and NH_3 in the flue gas, and CO concentration on the conversion of reactive nitrogen has been investigated. Results show that there is a temperature window around 1250 K where both HCN and NH_3 act as reducing agents for NO, yielding a decrease in total fixed nitrogen. Presence of CO and other combustibles move the window towards lower temperatures, below 1000 K at 2% CO. In the temperature window significant amounts of intermediate N_2O is

formed. A preliminary chemical kinetic model involving 35 components and 160 reactions has been established to analyze the results. (AB) (17 refs.)

33776 (NEI-NO–358) **Atmospheric CO_2 and global warming: A critical review.** Jaworowski, Z. (Norsk Polarinstitutt, Oslo (Norway)); Segalstad, T.V.; Hisdal, V. Norsk Polarinstitutt, Oslo (Norway). May 1992. 76p. Order Number DE93525291. Source: OSTI; NTIS.

2. revised ed.

The projections of man-made climate change through burning of fossil carbon fuels (coal, gas, oil) to CO_2 gas are based mainly on interpretations of measured CO_2 concentrations in the atmosphere and in glacier ice. These measurements and interpretations are subject to serious uncertainties. Dominant factors in the Earth's surface CO_2 cycle are the ocean, in addition to mineral equilibria. Due to their vast buffer capacity, they stabilize the geochemical equilibrium of CO_2 gas between the hydro-, atmo-, litho- and biosphere. The 19th century measurements of CO_2 in the atmosphere were carried out with an error of up to 100%. A value of 290 ppmv (parts per million, by volume) was chosen as an average for the 19th century atmosphere, by rejecting "not representative" measured values which differed more than 10% from the "general average for the time". Attempts have been made to calculate the paleoatmospheric CO_2 content from $^{13}C/^{12}C$ carbon stable-isotope ratios in tree rings. It is concluded here that the CO_2 content in the atmosphere calculated from such carbon isotope analyses cannot be considered a valid tool in paleoclimatology, nor can it be used as evidence of changing atmospheric CO_2 levels. The so-called increasing "greenhouse effect" signal, i.e. anthropogenic increase of the global air temperature, which was claimed to have been observed during the last decades, is not confirmed by recent studies of long temperature series. In the Arctic, according to model calculations, this warming should be most pronounced. However, cooling rather than warming has been recorded in this region during the last two decades. Glacier balance studies provide evidence for a recent decrease in glacier retreat, and for an increased accumulation over the polar ice caps, corresponding to a sea level lowering of about 1 mm per year. 255 refs., 10 figs., 2 tabs.

33777 (NUTEK-VK–93-4) **Reduction of nitrogen oxides in exhaust gases from diesel engines in a 5 kW stainless steel CFB-plant.** Wingaard, S. (Chalmers Univ. of Technology, Goeteborg (Sweden). Dept of Energy Conversion); Leckner, B. Swedish National Board for Industrial and Technical Development (NUTEK), Stockholm (Sweden); Chalmers Univ. of Technology, Goeteborg (Sweden). Dept. of Energy Conversion. [1993]. 22p. (In Swedish). Project NUTEK-566-002. (CTH-A–91-196). Order Number DE93795070. Source: OSTI; NTIS.

Experiments to determine the reduction of nitric oxide in diesel exhaust have been performed. The experimental set-up consists of a diesel engine connected to a small circulating fluidized bed (CFB) stainless steel combustor. The riser has a height of 5.6 m and a diameter of 52 mm. A zero test with no bed material and propane as fuel showed high reduction during fuel-rich combustion. This reduction was mainly caused by the catalytic effect of the hot tube walls. Experiments with bed material gave slightly higher reduction. Coal instead of propane as fuel also gave a higher reduction. This was mainly due to high carbon monoxide concentration during coal combustion. The catalytic effect of the wall influenced the experiments severely, so the results from these experiments cannot be applied to a full-scale facility. One important question, therefore, about the char influence of the reduction of nitric oxide, is not answered. (12 refs., 10 figs., 3 tabs.).

33778 (ORNL/M–2936) **The urban perspectives of acid rain: Workshop summary.** Tonn, B.E. Oak Ridge National Lab., TN (United States). 4 Jun 1993. 123p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (CONF-9209381–Summ.: The urban perspective of acid rain, Raleigh, NC (United States), 23-24 Sep 1992). Order Number DE93018881. Source: OSTI; NTIS; INIS; GPO Dep.

This report documents discussions held during a workshop an Urban Perspective of Acid Rain. The workshop was sponsored by the Office of the Director, National Acid Precipitation Assessment Program (NAPAP). NAPAP anticipates giving increased emphasis to the benefits in urban areas of emissions reductions. The goal of this informal, exploratory workshop was to serve as a first step towards identifying pollutant monitoring, and research and assessment needs to help answer, from an urban perspective, the two key questions posed to NAPAP by Congress: (1) what are the costs, benefits, and effectiveness of the acid rain control program, and (2) what reductions in deposition, rates are needed in order to prevent adverse effects? The workshop addressed research activities needed to respond to these questions. The discussions focused. sequentially, on data needs, data and model availability, and data and modeling gaps. The discussions concentrated on four areas of effects: human health, materials, urban forests, and visibility.

33779 (ORNL/TM–12409) **Characterization of ventilation ductwork in building K-31 at the Oak Ridge K-25 Site.** Klasson, K.T.; Corder, S.L. Oak Ridge National Lab., TN (United States). Aug 1993. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93019818. Source: OSTI; NTIS; INIS; GPO Dep.

An extensive sampling and analysis program was initiated in mid-August 1992 to characterize the ductwork of Building K-31 at the Oak Ridge K-25 Site. This building, 15 acres under roof, contains approximately 4,000 ft of main exhaust ducts (plenums), not including the side laterals, which are extensive. A large number of hexane-moistened wipe samples were taken from randomly selected locations within the seven main plenums and the side lateral ducts. Some samples were taken from the air-intake ducts as well. Three wipes were taken from each location and were analyzed for polychlorinated biphenyls (PCBs), uranium, and technetium. These samples were augmented with ten metal coupon samples (cut from the ducts) that were analyzed for radionuclides and subjected to Toxicity Characteristic Leaching Procedure analyses for toxic metals, base/neutral/acid compounds, and volatile organic compounds. Based on the wipe analyses (with 95% confidence), 95% of the contamination levels in the ductwork are as follows. PCB levels are <200, <760, and <96 $\mu g/100$ cm^2 for the main plenums, side lateral ducts, and air-intake ducts respectively; uranium levels are $<1,390$, $<8,430$, and <340 $\mu g/100$ cm^2 for the main plenums, side lateral ducts, and air-intake ducts respectively; and technetium levels are $<3,130$, $<167,000$, and $<2,570$ pCi/100 cm^2 for the main plenums, side lateral ducts, and air-intake ducts respectively. These values are higher than the contamination limits for the respective contaminants.

33780 (PNL–8744) **Pantex Plant meteorological monitoring program.** Snyder, S.F. Pacific Northwest Lab., Richland, WA (United States). Jul 1993. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93018495. Source: OSTI; NTIS; INIS; GPO Dep.

The current meteorological monitoring program of the US Department of Energy's Pantex Plant, Amarillo, Texas, is described in detail. Instrumentation, meteorological data collection and management, and program management are reviewed. In addition, primary contacts are noted for instrumentation, calibration, data processing, and alternative databases. The quality assurance steps implemented during each portion of the meteorological monitoring program are also indicated.

33781 (PNL-SA–22658) **The carbon dioxide emissions game: Playing the net.** Richards, K.R.; Edmonds, J.A.; Rosenthal, D.H.; Wise, M. Pacific Northwest Lab., Richland, WA (United States). Jun 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9306214–1: Carbon sinks workshop for the interagency national action plan development process, Washington, DC (United States), 10-11 Jun 1993). Order Number DE93017670. Source: OSTI; NTIS; GPO Dep.

Concern about rising concentrations of carbon dioxide in the earth's atmosphere has led to calls for the United States and other countries to reduce carbon emissions. These concerns resulted in the signing of the Framework Convention on Climate Change at the United Nations Conference on the Environment and Development in Rio de Janeiro in June 1992. The Framework calls for nations to develop action plans for limiting emissions of carbon and other greenhouse gases. In December 1992, in accordance with the Framework, the US Government released for public comment

its National Action Plan for Global Climate Change (US Department of State, 1992). The Action Plan detailed steps for reducing carbon emissions by 93 to 130 million metric tons (MMT) by 2000. Some of the steps included in the Action Plan were reforming regulations, setting energy standards, promoting research and development of new energy technologies, expanding the use of alternative-fueled vehicles, and planting trees to sequester carbon. This paper explores the economic implications of implementing a much larger tree-planting program than the one presented in the Action Plan. Whereas the Action Plan estimated that 5 to 9 MMT of carbon (MMTC) could be sequestered in 2000 (with perhaps threefold increases in sequestration in later years when trees are growing the fastest), the program being considered in this analysis annually sequesters as much as 231 MMTC during its peak years. Our analysis focuses on how much the costs of stabilizing US carbon emissions at 1990 levels are reduced when economic criteria alone determine the number of trees that will be used. Our results show that when the focus is shifted from stabilization of gross emissions to net emissions the cost reductions are dramatic, about 20 to 80 percent depending on the assumed cost of trees. Political and institutional obstacles to the formation of such a cost effective response are explored in the conclusions.

33782 (PPL–2923) **Removing CFC's from the atmosphere with lasers – a second look.** Stix, T.H. Princeton Univ., NJ (United States). Plasma Physics Lab. Jul 1993. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03073. (CONF-930652–1: 20. IEEE international conference on plasma sciences, Vancouver (Canada), 7-9 Jun 1993). Order Number DE93017516. Source: OSTI; NTIS; INIS; GPO Dep.

An option to both mitigate greenhouse warming and to help preserve the ozone layer could be to remove chlorofluorocarbons (CFC's) from their principal reservoir, the troposphere. But due to the extremely low atmospheric concentration of the CFC's (less than one part per billion by volume), such a process must be enormously selective to be cost-effective. It was suggested in 1989 that vast arrays of extremely powerful infrared lasers might be used to break up tropospheric CFC's via multiphoton dissociation (MPD). Computer calculations making use of an extensive atmospheric-gas infrared cross-section database suggest that – at carefully chosen wavelengths – 90% transmission over 50-kilometer paths would be possible through dry atmospheres. Still, a factor of 10 or 20 greater efficiency for the laser-CFC dissociation process is needed to bring the projected costs down to where the plan would merit serious consideration. The likeliest possibility for improvement appears to be to "chirp" the infrared laser frequency, that is, lowering its frequency during each pulse so as to remain in resonance – as long as possible – with the anharmonic vibrations of the CFC molecules. What is needed is a factor of 10 or more decrease below the laser-beam fluence now thought to be required for CFC infrared multiphoton dissociation. Specifically, one would look to achieve CFC NTD with an infrared fluence of 0.1 to 0.2 joules per cm^2. This goal may not be reachable, but laboratory experiments using presently available apparatus and techniques could explore this intriguing question. Following a summary of present knowledge concerning ozone depletion, this paper discusses the process of multiphoton dissociation and ways, including laser chirping, by which the MPD efficiency might be enhanced.

33783 (SAND–93-1044) **Volatile organic monitor for industrial effluents.** Laguna, G.R.; Peter, F.J.; Stuart, A.D.; Loyola, V.M. Sandia National Labs., Albuquerque, NM (United States). Jul 1993. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018692. Source: OSTI; NTIS; INIS; GPO Dep.

1990 amendments to the Clean Air Act have created the need for instruments capable of monitoring volatile organic compounds (VOCS) in public air space in an unattended and low cost manner. The purpose of the study was to develop and demonstrate the capability to do long term automatic and unattended ambient air monitoring using an inexpensive portable analytic system at a commercial manufacturing plant site. A gas chromatograph system personal computer hardware, meteorology tower & instruments, and custom designed hardware and software were developed. Comparison with an EPA approved method was performed. The system was sited at an aircraft engines manufacturing site and operated in a completely unattended mode for 60 days. Two VOCs were monitored every 30 minutes during the 24hr day. Large variation in the concentration from 800ppb to the limits of detection of about 10ppb were observed. Work to increase the capabilities of the system is ongoing.

33784 (SAND–93-7031) **Effects of the Mount Pinatubo eruption on solar insolation: Four case studies.** Rosenthal, A.L. (New Mexico State Univ., Las Cruces, NM (United States). Southwest Technology Development Inst.); Robert, J.M. Sandia National Labs., Albuquerque, NM (United States); New Mexico State Univ., Las Cruces, NM (United States). Southwest Technology Development Inst. May 1993. 60p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018454. Source: OSTI; NTIS; GPO Dep.

The Southwest Technology Development Institute staff analyzed solar insolation data from four sites recorded during the years 1990 through 1992. Analyses were performed to identify and quantify the effects on insolation caused by the eruption of Mount Pinatubo in the Philippines on June 15th and 16th, 1991. The four monitoring stations that supplied the raw data for this report were: The Southwest Region Experiment Station in Las Cruces, New Mexico; The Solar Radiation Research Laboratory at the National Renewable Energy Laboratory in Golden, Colorado; The Solar Insolation Monitor Program station operated by the Pacific Gas and Electric Company in Carrisa Plains, California; and The Solar Insolation monitor station at Sandia National Laboratories in Albuquerque, New Mexico. Data from each of the sites were recorded by dedicated datalogging equipment. Every effort was made to prevent data acquisition system problems (e.g., drift of the datalogger clock) from influencing the accuracy of the results.

33785 (SAND–93-8011) **Environmental Monitoring Plan.** Holland, R.C. (Science Applications International Corp., San Diego, CA (United States)). Sandia National Labs., Livermore, CA (United States). Jul 1993. 188p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018697. Source: OSTI; NTIS; INIS; GPO Dep.

This Environmental Monitoring Plan was written to fulfill the requirements of Department of Energy (DOE) Order 5400.1 and DOE Environmental Regulatory Guide DOE/EH 0173T. This Plan documents the background, organizational structure, and methods used for effluent monitoring and environmental surveillance at Sandia National Laboratories/California. The design, rationale, and historical results of the environmental monitoring system are discussed in detail. Throughout the Plan, recommendations for improvements to the monitoring system are made. This revision to the Environmental Monitoring Plan was written to document the changes made to the Monitoring Program during 1992. Some of the data (most notably the statistical analyses of past monitoring data) has not been changed.

33786 (UCRL-ID–110618) **Engineering Assessment and Certification of Integrity of the 490-Q1 tank system.** Schwartz, W.W. (Lawrence Livermore National Lab., CA (United States)); Gee, C.W.; Graser, D.A. Lawrence Livermore National Lab., CA (United States). Jul 1993. 171p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93019551. Source: OSTI; NTIS; GPO Dep.

This Engineering Assessment and Certification of Integrity of used freon storage tanks 490-Q1A1 and 490-Q1A2 has been prepared in response to 40 CFR 265.192(a) and 22 CCR 66265.192(a) for new tank systems that store hazardous waste and have secondary containment. The regulations require that this assessment be completed and certified by an independent, qualified, California-registered professional engineer before the tank system is placed in use as a hazardous waste storage tank system. The technical assessments for the 490-Q1A1 and 490-Q1A2 tank systems have been reviewed by an independent, qualified, California-registered professional engineer, who has certified that the tank systems have sufficient structural integrity, are acceptable for transferring and storing hazardous waste, are compatible with the stored waste, and the tanks and containment system are suitably designed to achieve the requirements of the applicable regulations so they will not collapse, rupture, or fail.

33787 (UCRL-ID–113761) **Moments of ambient Doppler spectra.** Lehman, S.K. Lawrence Livermore National Lab., CA (United States). 23 Mar 1993. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93017948. Source: OSTI; NTIS; GPO Dep.

The author studied the first four moments (center of mass, standard deviation, skew, and kurtosis) of the Doppler spectra in ambient regions of LLNL-Hughes real aperture radar data collected during WCSEX91–92. The goal was to correlate trends in the moments with wind velocity and direction. Although the center of mass appears to increase when the wind is blowing into the radar antenna, no other conclusions have been drawn from the higher order moments.

33788 (UCRL-ID–114054) **Inclusion of a three-dimensional washout coefficient in ADPIC.** Naeslund, E.; Holmstroem, H. Lawrence Livermore National Lab., CA (United States). May 1993. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93018499. Source: OSTI; NTIS; INIS; GPO Dep.

In ADPIC, the deposition emerging from washout has thus far been modelled rather crudely, since the only option has been to turn the rain on and off at different times. This kind of modelling is particularly unsatisfactory when ADPIC is used to model continuous releases over long periods of time. The assumption of simultaneous rain throughout such a large plume is simply not true. In this report a modified version of ADPIC with a three-dimensional (3-D) washout coefficient is presented. The effect of space variable precipitation is examined via two separate releases that are simulated for a period of 48 hours: one continuous 'Chernobyl-like source' release and one instantaneous 'nuclear explosion-like'. Simulations with both the new and old formulation are made and the resulting deposition patterns are compared.

33789 (UCRL-JC–113039) **Toward a high performance distributed memory climate model.** Wehner, M.F. (Lawrence Livermore National Lab., CA (United States)); Ambrosiano, J.J.; Brown, J.C.; Dannevik, W.P.; Eltgroth, P.G.; Mirin, A.A.; Farrara, J.D.; Ma, C.C.; Mechoso, C.R.; Spahr, J.A. Lawrence Livermore National Lab., CA (United States). 15 Feb 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9307111–2: 2. international symposium on high-performance distributed computing, Spokane, WA (United States), 20-23 Jul 1993). Order Number DE93019156. Source: OSTI; NTIS; GPO Dep.

As part of a long range plan to develop a comprehensive climate systems modeling capability, the authors have taken the Atmospheric General Circulation Model originally developed by Arakawa and collaborators at UCLA and have recast it in a portable, parallel form. The code uses an explicit time-advance procedure on a staggered three-dimensional Eulerian mesh. The authors have implemented a two-dimensional latitude/longitude domain decomposition message passing strategy. Both dynamic memory management and interprocessor communication are handled with macro constructs that are preprocessed prior to compilation. The code can be moved about a variety of platforms, including massively parallel processors, workstation clusters, and vector processors, with a mere change of three parameters. Performance on the various platforms as well as issues associated with coupling different models for major components of the climate system are discussed.

33790 (UCRL-JC–114013) **Modeling and measurements of nocturnal drainage flows along the Front Range of the Rocky Mountains.** Leone, J.M. Jr.; Gudiksen, P.H. Lawrence Livermore National Lab., CA (United States). May 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930810–4: Topical meeting on environmental transport and dosimetry, Charleston, SC (United States), 31 Aug - 3 sep 1993). Order Number DE93016527. Source: OSTI; NTIS; GPO Dep.

In support of the DOE ASCOT program Lawrence Livermore National Laboratory has analyzed the wind, temperature, and net radiation measurements acquired by the network of sensors situated within and outside the Coal Creek Canyon drainage area during 1991. It is shown that strong cooling rates, between 50–80 W/m^2, generate will defined drainage flows with a maximum speed of approximately 6 m/s. A cooling rate of 15–30 W/m^2, produces a significantly weaker drainage flow and further reduction of the cooling rate results in the failure of any significant drainage flows to form. In an attempt to further understand these flows researchers conducted numerical simulations of two representative flows.

33791 (UCRL-JC–114098) **Application of an atmospheric dispersion model to simulated pollutant releases in the Colorado Front range.** Lange, R. Lawrence Livermore National Lab., CA (United States). May 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930810–5: Topical meeting on environmental transport and dosimetry, Charleston, SC (United States), 31 Aug - 3 sep 1993). Order Number DE93017118. Source: OSTI; NTIS; GPO Dep.

The 1991 ASCOT (Atmospheric Studies in Complex Terrain) field study in the vicinity of the Department of Energy's Rocky Flats Plant, Colorado, was conducted to study the local and regional circulations and their interactions with synoptic flows over the complex terrain of the Rocky Mountains Colorado Front range. The study was combined with the Rocky Flats Winter validation Study (WVS) which had similar objectives. Tracer plumes were released as part of this field campaign over the period of February 3–19, 1991 from the Rocky Flats Plant. Twelve intensive experiments, centered around eleven-hour long surface releases of sulfur hexafloride (SF_6)tracer material, were conducted by teams from a number of national laboratories, government agencies and private contractors. One-hourly averaged tracer concentrations were collected from approximately 170 surface samplers deployed along two concentric circles at a radius of 8 km and 16 km from the release location. The concentration patterns resulting from the transport and turbulent diffusion of the SF_6 traces plumes within the atmospheric boundary layer during two night-time, one morning transition, and one day-time period were simulated for this paper. The scenarios selected represent the first-choice of all twelve experiments to be addressed, based on the quality and completeness of the collected data base and the presence of the desired meteorological conditions.

33792 (UCRL-JC–114930) **A real-time monitoring/emergency response modeling workstation for a tritium facility.** Lawver, B.S. (Lawrence Livermore National Lab., CA (United States)); Sims, J.M.; Baskett, R.L. Lawrence Livermore National Lab., CA (United States); EG and G Energy Measurements, Inc., Pleasanton, CA (United States). Jul 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48 ;AC08-88NV10617. (CONF-931160–15: American Nuclear Society (ANS) winter meeting, San Francisco, CA (United States), 14-19 Nov 1993). Order Number DE93018630. Source: OSTI; NTIS; INIS; GPO Dep.

At Lawrence Livermore National Laboratory (LLNL) we developed a real-time system to monitor two stacks on our tritium handling facility. The monitors transmit the stack data to a workstation which computes a 3D numerical model of atmospheric dispersion. The workstation also collects surface and upper air data from meteorological towers and a sodar. The complex meteorological and terrain setting in the Livermore Valley demands more sophisticated resolution of the three-dimensional structure of the atmosphere to reliably calculate plume dispersion than afforded by Gaussian models. We experience both mountain valley and sea breeze flows. To address these complexities, we have implemented the three-dimensional diagnostic MATHEW mass-adjusted wind field and ADPIC particle-in-cell dispersion models on the workstation for use in real-time emergency response modeling. Both MATHEW and ADPIC have shown their utility in a variety of complex settings over the last 15 years within the Department of Energy's Atmospheric Release Advisory Capability (ARAC[1,2]) project.

33793 (WSRC-MS–93-326) **Environmental ALARA Program at the Savannah River Site.** Jannik, G.T. Westinghouse Savannah River Co., Aiken, SC (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-9307103–4: 11. international system safety conference, Cincinnati, OH (United States), 28 Jul - 2 aug 1993). Order Number DE93018193. Source: OSTI; NTIS; INIS; GPO Dep.

The Savannah River Site (SRS) follows the ALARA (As Low As Reasonably Achievable) philosophy of keeping radiation doses to the general public as low as practical by minimizing radioactive releases to the environment. SRS accomplishes this goal by establishing challenging sitewide and area-specific Environmental ALARA Release Guides and trending radioactive releases against these guides on a monthly basis. The SRS Environmental ALARA Program, mandated by DOE Order 5400.5, is a dose-based program that has gone through many changes and improvements in recent years. A description of the SRS Environmental ALARA Program and its performance is presented in this paper. Recent SRS studies of the "Zero Release" option also are described.

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Refer also to citation(s) 32199, 32304, 32306, 32307, 32357, 32367, 32370, 32384, 32393, 32408, 32409, 32415, 32426, 32431, 32432, 32434, 32435, 32436, 32437, 32443, 32445, 32448, 32449, 32455, 32456, 32457, 32458, 32459, 32461, 32464, 32469, 32471, 32473, 32479, 32486, 32502, 32504, 32509, 32514, 32515, 32516, 32526, 32529, 32532, 32533, 32537, 32538, 32541, 32544, 32546, 32547, 32550, 32552, 32556, 32559, 32561, 32562, 32564, 32565, 32568, 32569, 32570, 32571, 32579, 32580, 32680, 32913, 33292, 33294, 33299, 33336, 33337, 33713, 33759, 33766, 33773, 33849, 33855, 33919, 33946, 33947, 33961, 34494, 34653, 34654

33794 (ANL–93/13) **ANL technical support program for DOE Environmental Restoration and Waste Management: Annual report, October 1991–September 1992.** Bates, J.K. (Argonne National Lab., IL (US)); Bradley, C.R.; Buck, E.C.; Cunnane, J.C.; Dietz, N.L.; Ebert, W.L.; Emery, J.W.; Feng, X.; Gerding, T.J.; Gong, M.; Hoh, J.C.; Mazer, J.J.; Wronkiewicz, D.J.; Bourcier, W.L.; Morgan, L.E.; Newton, L.; Nielsen,.Argonne National Lab., IL (United States). May 1993. 212p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93018116. Source: OSTI; NTIS; INIS; GPO Dep.

A program was established for DOE Environmental Restoration and Waste Management (EM) to evaluate factors that are anticipated to affect waste glass reaction during repository disposal, especially in an unsaturated environment typical of what may be expected for the proposed Yucca Mountain repository site. This report covers progress in FY 1992 on the following tasks: 1. A compendium of the characteristics of high-level nuclear waste borosilicate glass has been written. 2. A critical review of important parameters that affect the reactivity of glass in an unsaturated environment is being prepared. 3. A series of tests has been started to evaluate the reactivity of fully radioactive glasses in a high-level waste repository environment and compare it to the reactivity of synthetic, nonradioactive glasses of similar composition. 4. The effect of radiation upon the durability of waste glasses at a high glass surface area-to-liquid volume (SA/V) ratio and a high gas-to-liquid volume ratio will be assessed. These tests address both vapor and high SA/V liquid conditions. 5. A series of tests is being performed to compare the extent of reaction of nuclear waste glasses at various SAN ratios. Such differences in the SAN ratio may significantly affect glass durability. 6. A series of natural analogue tests is being analyzed to demonstrate a meaningful relationship between experimental and natural alteration conditions. 7. Analytical electron microscopy (AEM), infrared spectroscopys and nuclear resonant profiling are being used to assess the glass/water reaction pathway by identifying intermediate phases that appear on the reacting glass. Additionally, colloids from the leach solutions are being studied using AEM. 8. A technical review of AEM results is being provided. 9. A study of water diffusion involving nuclear waste glasses is being performed. 10. A mechanistically based model is being developed to predict the performance of glass over repository-relevant time periods.

33795 (ANL/ER/CP–79013) **Development of technology performance specifications for volatile organic compounds.** Purdy, C. (Dept. of Energy, Germantown, MD (US). Office of Environmental and Waste Management); Schutte, W.E.; Erickson, M.D.; Carpenter, S.C.; Doskey, P.V.; Lindahl, P.C.; Pflug, A.D. Argonne National Lab., IL (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9307101–2: 9. annual waste testing and quality assurance symposium, Arlington, VA (United States), 12-16 Jul 1993). Order Number DE93017705. Source: OSTI; NTIS; INIS; GPO Dep.

The Office of Technology Development (OTD) within the Office of Environmental Restoration and Waste Management of the Department of Energy has a mission to deliver needed and usable technologies to its customers. The primary customers are individuals and organizations performing environmental characterization and remediation, waste cleanup, and pollution prevention at DOE sites. DOE faces a monumental task in cleaning up the dozen or so major sites and hundreds of smaller sites that were or are used to produce the US nuclear weapons arsenal and to develop nuclear technologies for national defense and for peaceful purposes. Contaminants and waste materials include the radionuclides associated with nuclear weapons, such as plutonium and tritium, and more common pollutants and wastes of industrial activity such as chromium, chlorinated solvents, and polychlorinated biphenyls (PCBs). Quite frequently hazardous wastes regulated by the Environmental Protection Agency are co-mingled with radioactive wastes regulated by the Nuclear Regulatory Commission to yield a "mixed waste," which increases the cleanup challenges from several perspectives. To help OTD and its investigators meet DOE's cleanup goal, technology performance specifications are being implemented for research and development and DT&E projects. Technology performance specifications or "performance goals" describe, quantitatively where possible, the technology development needs being addressed. These specifications are used to establish milestones, evaluate the status of ongoing projects, and determine the success of completed projects.

33796 (ANL/ESD/TM–50) **Videographic enhancement of GRASS imagery: Recent advances.** Sullivan, R.G. Argonne National Lab., IL (United States). Jun 1992. 39p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93018871. Source: OSTI; NTIS; GPO Dep.

The Geographic Resource Analysis Support System (GRASS), a geographic information system, has been fielded at approximately 50 US Army training installations as a land-management decision-making tool. Use of the GRASS geographic information system involves the production of numerous digital maps of environmental parameters, such as elevation, soils, hydrography, etc. A recently emerging technology called computer videographics can be used to graphically enhance GRASS images, thereby creating new ways to visualize GRASS analysis results. The project described in this report explored the enhancement of GRASS images through the use of videographic technology. General image quality of videographically enhanced GRASS images was improved through the use of high-resolution imagery and improved software. Several new types of geographic data visualizations were developed, including three-dimensional shaded-relief maps of GRASS data, overlay of GRASS images with satellite images, and integration of computer-aided-design imagery with GRASS images. GRASS images were successfully enhanced using Macintosh hardware and software, rather than the DOS-based equipment used previously. Images scanned with a document scanner were incorporated into GRASS imagery, and enhanced images were output in an S-VHS high-resolution video format.

33797 (ANL/ESD/TM–51) **Geophysical study of the Building 103 Dump, Aberdeen Proving Ground.** McGinnis, L.D.; Miller, S.F.; Thompson, M.D.; McGinnis, M.G. Argonne National Lab., IL (United States). Dec 1992. 41p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93019857. Source: OSTI; NTIS; GPO Dep.

The Building 103 Dump is one of ten potentially contaminated sites in the Canal Creek and Westwood areas of the Edgewood section of Aberdeen Proving Ground examined by a geophysical team from Argonne National Laboratory in April and May of 1992. Noninvasive geophysical surveys, including magnetics, resistivity, ground-penetrating radar, and seismic refraction, were conducted. These surveys indicate that much of the area is free of debris.

However, prominent magnetic and resistivity anomalies occur along well-defined lineaments, suggestive of a dendritic stream pattern. Prior to the onset of dumping, the site was described as a "sand pit," which suggests that headward erosion of Canal Creek tributaries cut into the surficial aquifer. Contaminants dumped into the landfill would have direct access to the surficial aquifer and thus to Canal Creek. Seismic refraction profiling indicates 6–12 ft of fill material now rests on the former land surface. Only the northern third of the former landfill was geophysically surveyed.

33798 (BNL–48749) **Regulatory issues and assumptions associated with barriers in the vadose zone surrounding buried waste.** Siskind, B.; Heiser, J. Brookhaven National Lab., Upton, NY (United States). Feb 1993. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE93019471. Source: OSTI; NTIS; INIS; GPO Dep.

One of the options for control of contaminant migration from buried waste sites is the construction of a subsurface barrier that consists of a wall of low permeability material. The barrier material should be compatible with soil and waste conditions specific to the site and have as low an effective diffusivity as is reasonably achievable to minimize or inhibit transport of moisture and contaminants. This report addresses the regulatory issues associated with the use of non-traditional organic polymer barriers as well as the use of soil-bentonite or cement-bentonite mixtures for such barriers, considering barriers constructed from these latter materials to be a regulatory baseline. The regulatory issues fall into two categories. The first category consists of issues associated with the acceptability of such barriers to the EPA as a method for achieving site or performanceimprovement. The second category encompasses those regulatory issues concerning health, safety and the environment which must be addressed regarding barrier installation and performance, especially if non-traditional materials are to be used.

33799 (BNL–49162) **National radiation exposures and risks caused by implementing EPA's proposed revised national primary drinking water regulations.** Morris, S.C.; Rowe, M.D.; Holtzman, S.; Meinhold, A.F. Brookhaven National Lab., Upton, NY (United States). May 1993. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE93018384. Source: OSTI; NTIS; INIS; GPO Dep.

This report estimates risks to workers and the public associated with treatment processes and their associated waste products that would be mandated under proposed regulations of radium, radon, and uranium in drinking water. Three scenarios were examined: (1) all wastes flushed to the sanitary sewer; (2) all wastes disposed on land; (3) similar to (2) but radon removal by granulated activated carbon rather than packed tower aeration. Risks considered included accidental injury and cancer. Worker risks for both scenarios I and II were estimated to be 0.025 and 0.01 deaths per year of operation for radium-226 and radium-228, respectively. Worker risks for uranium were estimated to be 0.13 deaths/year of operation for scenario I and 0.5 deaths/year of operation for scenario II. Worker risks for radon removal were estimated to be 1.7 deaths/year of operation for scenario I and 2.2 deaths/year of operation for scenario II. Risks to the public for scenarios I and II for radium-226 were 4×10^{-4} and for radium-228 were 9×10^{-5} deaths/year of operation. Risks to the public for scenarios I and II for uranium were 7.3×10^{-2} and 2×10^{-4}, respectively. Risks to the public for scenario I and II for radon were 24 deaths/year of operation and for scenario III were nil. Public risks were quantified only for people exposed during a year of operation. For example, effects of public exposures in future years via groundwater contamination associated with landfill of treatment waste were not considered.

33800 (BNL–70331) **Biological research in Wales and England: Foreign trip report, March 22–April 1, 1993.** Long, S.P. Brookhaven National Lab., Upton, NY (United States). 22 Apr 1993. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE93014310. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of this trip was to present findings of biological research conducted within the Brookhaven National Laboratory. FACE system in invited lectures to two European research conferences, and specifically to present our findings on the acclimatization of wheat photosynthesis to elevated CO_2 concentrations. To inform audiences, from a biological perspective, the potential advantages of the FACE approach to advancing understanding of the impact of rising CO_2 concentrations on vegetation. To obtain information on British and EEC initiatives in research on the effects of rising CO_2 concentrations on vegetation and in particular photosynthesis. To obtain information on new DNA probes for genes of key enzymes of photosynthesis and carbohydrate metabolism that might be of value in the current USDA/BNL FACE-Wheat experiment, and subsequent FACE experiments. To meet with staff from ETH, Zurich, to discuss my possible involvement with the Swiss-FACE experiment.

33801 (DOE/FTR–93014867) **Travel to Europe for research in INTRAVAL; modelling brine inflow and groundwater flow at WIPP: Foreign trip report, March 27–April 3, 1993.** Gorham, E.D. Sandia National Labs., Albuquerque, NM (United States). 3 Jun 1993. 86p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93014867. Source: OSTI; NTIS (US Sales Only); GPO Dep.

At the INTRAVAL Working Group III meeting both WIPP test cases (the Salt Test Case and the Culebra Test Case) were discussed by foreign project team members. Modeling of brine inflow experiments, from the WIPP Salt Test Case, by the French team yielded permeability and storativity values consistent with those already derived by the WIPP project team. Modeling of variable density ground water flow above the WIPP site, pertinent to the WIPP Culebra Test Case, by the German team is not sufficiently far along to have yielded results. Difficulties with numerical simulation have delayed progress.

33802 (DOE/FTR–93016249) **Travel to Germany to participate in the 4th International KfK/TNO conference on contaminated soil: Foreign trip report, May 3–7, 1993.** Miller, D.F. EG and G Idaho, Inc., Idaho Falls, ID (United States). 24 Jun 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93016249. Source: OSTI; NTIS (US Sales Only); GPO Dep.

For the first time, an international gathering of about 1000 experts (mostly Germans) in different fields of contaminated soil meeting Berlin, Germany, heard a number of talks on the EM/OTD mission, organization, and received an overview of RDDT&E, cleanup, and waste prevention activities. This was the fourth international conference on contaminated soils held in Europe and the first at which EM was a sponsor, gave significant invited papers. Specifically, the author's paper was one of a number of papers by EM and National Lab participants in the Workshop on Mixed Waste. Workshop attendees asked many questions and the session was very interactive. At least some Europeans now understand, in part EM's mixed waste cleanup needs and the role of advanced and innovative technologies in the cleanup of such contaminated sites.

33803 (DOE/FTR–93018609) **Travel to the Netherlands and Russia to assess electrokinetic technology as it is being applied to the remedial treatment of metal-contaminated soils and groundwater: Foreign trip report, December 11–19, 1991.** Adams, R.E. USDOE Oak Ridge Field Office, TN (United States). 8 Jan 1992. 65p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93018609. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of this trip was to serve as a member of an evaluation team composed of the Department of Energy (DOE) and DOE contractor personnel to evaluate and assess the state of international electrokinetic technology as it is being applied to the remedial treatment of metal-contaminated soils and groundwater. This travel was requested by the DOE Office of Technology Development (OTD) to determine whether electrokinetic technology research, development, and field demonstrations on foreign soils and groundwater have applicability for the remediation of metal contamination at DOE sites.

33804 (DOE/ID–22107) **Age dating ground water by use of chlorofluorocarbons (CCl_3F and CCl_2F_2), and distribution of chlorofluorocarbons in the unsaturated zone, Snake River Plain aquifer, Idaho National Engineering Laboratory, Idaho.** Busenberg, E.; Weeks, E.P.; Plummer, L.N.; Bartholomay, R.C.

Geological Survey, Idaho Falls, ID (United States). Apr 1993. 47p. Sponsored by Geological Survey, Reston, VA (United States). DOE Contract AC07-76ID01570. (USGS-WRI–93-4054). Order Number DE93019032. Source: OSTI; NTIS; INIS; GPO Dep.

Detectable concentrations of chlorofluorocarbons (CFC's) were observed in ground water and unsaturated-zone air at the Idaho National Engineering Laboratory (INEL) and vicinity. The recharge ages of waters were determined to be from 4 to more than 50 years on the basis of CFC concentrations and other environmental data; most ground waters have ages of 14 to 30 years. These results indicate that young ground water was added at various locations to the older regional ground water (greater than 50 years) within and outside the INEL boundaries. The wells drilled into the Snake River Plain aquifer at INEL sampled mainly this local recharge. The Big Lost River, Birch Creek, the Little Lost River, and the Mud Lake-Terreton area appear to be major sources of recharge of the Snake River Plain aquifer at INEL. An average recharge temperature of 9.7±1.3°C (degrees Celsius) was calculated from dissolved nitrogen and argon concentrations in the ground waters, a temperature that is similar to the mean annual soil temperature of 9°C measured at INEL. This similarity indicates that the aquifer was recharged at INEL and not at higher elevations that would have cooler soil temperatures than INEL. Soil-gas concentrations at Test Area North (TAN) are explained by diffusion theory.

33805 (DOE/MC/29109–3392) **Road Transportable Analytical Laboratory (RTAL) system: Quarterly technical report, December 1992–February 1993.** Engineering Computer Optecnomics, Inc., Annapolis, MD (United States). 22 Mar 1993. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC21-92MC29109. Order Number DE93040019. Source: OSTI; NTIS; INIS; GPO Dep.

The goal of this contractual effort is the development and demonstration of a Road Transportable Analytical Laboratory (RTAL) system to meet the unique needs of the Department of Energy (DOE) for rapid, accurate analysis of a wide variety of hazardous and radioactive contaminants in soil, groundwater, and surface waters. This laboratory system will be designed to provide the field and laboratory analytical equipment necessary to detect and quantify radionuclides, organics, heavy metals and other inorganics, and explosive materials. The planned laboratory system will consist of a set of individual laboratory modules deployable independently or as an interconnected group to meet each DOE site's specific needs.

33806 (ECN-RX–93-053) **Storage restrictions and the preference for CO_2 removal options.** Okken, P.A. Netherlands Energy Research Foundation (ECN), Petten (Netherlands). May 1993. 19p. Order Number DE93524584. Source: OSTI; NTIS; Available from the library of the Netherlands Energy Research Foundation (ECN), P.O. Box 1, 1755 ZG Petten (Netherlands).

Paper prepared for IEA CO_2 disposal symposium of the IEA Greenhouse R+D programme, Oxford, 29-31 March, 1993.

Carbon dioxide storage is a conditio sine qua non for carbon dioxide removal, i.e. recovery from fossil fuel conversion and storage in reservoirs outside the atmosphere. CO_2 storage capacity restrictions determine the cost-effectiveness of CO_2 removal techniques, preferring low-carbon high energy yield options. This is demonstrated in energy system model calculations, with variable CO_2 storage capacities and variable targets for CO_2 emission reduction. With restricted storage capacity the preference for CO_2 removal changes, from coal/synfuels to coal/power to gas/hydrogen conversion processes, at higher costs. 4 figs., 3 tabs., 3 refs.

33807 (EGG–10617-1219) **An aerial radiological survey of the Quad Cities Nuclear Power Station and surrounding area, Cordova, Illinois: Date of survey: May 1989.** Maurer, R.J. EG and G Energy Measurements, Inc., Las Vegas, NV (United States). Remote Sensing Lab. Apr 1993. 12p. Sponsored by Nuclear Regulatory Commission, Washington, DC (United States). DOE Contract AC08-93NV11265. Order Number DE93019093. Source: OSTI; NTIS; INIS; GPO Dep.

An aerial radiological survey was conducted over the Quad Cities Nuclear Power Station in Cordova, Illinois, during the period May 9 through May 18, 1989. The survey was conducted at an altitude of 61 meters (200 feet) over a 65-square-kilometer (25-square-mile) area centered on the power station. The purpose of the survey was to document the terrestrial gamma environment of the Quad Cities Power Station and surrounding area and to determine any radiological impact on the area over the past twenty years. The results of the aerial survey are reported as inferred gamma radiation exposure rates at 1 meter above ground level in the form of a contour map. Outside the plant boundary, exposure rates were found to vary between 5 and 15 microroentgens per hour (μR/h) and were attributed to naturally-occurring uranium, thorium, and radioactive potassium gamma emitters. The aerial data were compared to ground-based "benchmark" exposure rate measurements and radionuclide assay of soil samples obtained within the survey boundary. The ground-based measurements were found to be in good agreement with those inferred from the aerial measuring system.

33808 (EGG–10617-2155) **Population trends of San Joaquin kit fox (Vulpes velox macrotis) at Camp Roberts Army National Guard Training Site, California.** Berry, W.H.; Standley, W.G. EG and G Energy Measurements, Inc., Goleta, CA (United States). Santa Barbara Operations. Oct 1992. 25p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC08-88NV10617. Order Number DE93018484. Source: OSTI; NTIS; GPO Dep.

Population trends of a San Joaquin kit fox population (Vulpes velox macrotis) were investigated at Camp Roberts Army National Guard Training Site, California, from November 1989 through August 1991. Six semiannual livetrapping sessions and eight scent-station survey sessions were conducted. Livetrapping results and radiotelemetry data were used to calculate minimum population size, density, and distribution. A total of 175 individual foxes were trapped 463 times. The number of individuals trapped and minimum population size calculations showed a decline over time. The highest minimum population (109) was observed in winter 1988. Summer 1991 had the lowest minimum population size (45). No evidence was found to indicate that the apparent population decline was a result of military-authorized activities.

33809 (ENEA-RT-INN–92-41) **Report of first LASFLEUR field campaign for remote sensing of vegetation health: ENEA contribution.** Barbini, R. (ENEA, Frascati (Italy). Centro Ricerche Energia - Area Energia e Innovazione); Colao, F.; Fantoni, R.; Palucci, A.; Ribezzo, S. Nov 1992. 25p. (RT/INN–92-41). Order Number DE93522949. Source: OSTI; NTIS (US Sales Only); INIS.

The first European joint field campaign for the remote sensing of vegetation health was held in Viterbo (October 6 to 18, 1991) within the framework of the EUREKA/LASFLEUR project. Italian groups, from universities, ENEA (Italian Agency for Energy, New Technologies and the Environment) and CNR (Italian National Research Council), participated in this campaign together with several German groups from different institutes. The LIDAR (light detection and ranging) fluorosensor system built at the ENEA Frascati Research Center for the remote sensing of water and land was modified to detect fluorescence from trees in a field experiment. The new version of the set-up is presented in this paper together with the spectral and time resolved measurements that were performed. Results are discussed in view of correlating present data with the plant photosynthesis activity under different weather conditions and water stresses.

33810 (IAEA-SM–329/21/0) **Cesium-137 inventories in Alaskan Tundra, lake and marine sediments: An indicator of recent organic material transport?.** Grebmeier, J.M. (Oak Ridge National Lab., TN (United States)); Cooper, L.W.; Larsen, I.L.; Solis, C.; Olsen, C.R. International Atomic Energy Agency, Vienna (Austria); Oak Ridge National Lab., TN (United States). [1993]. 22p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States); Department of the Interior, Washington, DC (United States). DOE Contract AC05-84OR21400. DPP 88-13046;DPP 89-21955;DPP 92-17666. (CONF-930412–1: International symposium on the application of isotope techniques in studying past and current environmental changes in the hydrosphere and atmosphere, Vienna (Austria), 19-23 Apr 1993). Order Number DE93015888. Source: OSTI; NTIS; INIS; GPO Dep.

Tundra sampling was accomplished in 1989–1990 at Imnavait Creek, Alaska (68°37' N, 149°17' W). Inventories of ^{137}Cs (102–162 mBq/cm^2) are close to expectations, based upon measured atmospheric deposition for this latitude. Accumulated inventories of ^{137}Cs in tundra decrease by up to 50% along a transect to Prudhoe Bay (70°13' N, 148°30' W). Atmospheric deposition of ^{137}Cs decreased with latitude in the Arctic, but declines in deposition would have been relatively small over this distance (200 km). This suggests a recent loss of ^{137}Cs and possibly associated organic matter from tundra over the northern portions of the transect between Imnavait Creek and Prudhoe Bay. Sediments from Toolik Lake (68°38' N, 149°38' W) showed widely varying ^{137}Cs inventories, from a low of 22 mBq/cm^2 away from the lake inlet, to a high between 140 to >200 mBq/cm^2 near the main stream inflow. This was indicative of recent accumulation of cesium and possibly organic material associated with it in arctic lakes, although additional sampling is needed.

33811 (INIS-RU–347, pp. 419) **Study on the beta and gamma isotope concentration in environment beyond the 30 km Chernobyl NPP accident zone.** Belyavenko, V.S. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Vishnevskij, I.N.; Donets, N.P.; Zheltonozhskij, V.A.; Grudzhuk, M.Yu.; Lebedev, Yu.A.; Titarchuk, A.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. RADIATION MONITORING/chernobylsk-4 reactor; RADIATION MONITORING/spatial dose distributions; BETA DOSIMETRY; CESIUM 137; CONTAMINATION; ENVIRONMENT; GAMMA DOSIMETRY; ISOTOPE RATIO; RADIOACTIVITY; REACTOR ACCIDENTS; STRONTIUM 90

33812 (INIS-RU–350, pp. 30) **Study of vertical radionuclide distribution on calibration regional sites in the zone of the Chernobylsk NPP.** Stukin, E.D. (AN SSSR, Moscow (Russian Federation). Inst. Prikladnoj Geofiziki); Khalikova, R.Kh.; Sadol'ko, I.V.; Sushchik, Yu.Ya. AN SSSR, Moscow (Russian Federation). Inst. Geokhimii i Analiticheskoj Khimii. 1990. (In Russian). (CONF-9010541–: 4. Conference of scientific council at the GEOKHI of the USSR Academy of Sciences on the programme AEhS-VO, Gomel' (Belarus), 13 Oct 1990). In *Geochemical ways of artificial radionuclide migration in biosphere: Summaries of reports.* 159p. Order Number DE93633561. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. CHERNOBYLSK-4 REACTOR/reactor accidents; SURFACE CONTAMINATION/site characterization; DEPTH; RADIONUCLIDE MIGRATION; SPATIAL DISTRIBUTION; TERRESTRIAL ECOSYSTEMS

33813 (INIS-RU–350, pp. 65) **Distribution and radionuclide content of fuel particles in 60-rm zone of the Chernobylsk.** Galushkin, B.A.; Gorbunov, S.V.; Makushkin, S.G.; Malyshev, V.P. AN SSSR, Moscow (Russian Federation). Inst. Geokhimii i Analiticheskoj Khimii. 1990. (In Russian). (CONF-9010541–: 4. Conference of scientific council at the GEOKHI of the USSR Academy of Sciences on the programme AEhS-VO, Gomel' (Belarus), 13 Oct 1990). In *Geochemical ways of artificial radionuclide migration in biosphere: Summaries of reports.* 159p. Order Number DE93633561. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 fig., 1 tab. CHERNOBYLSK-4 REACTOR/reactor accidents; RADIOISOTOPES/radionuclide migration; CERIUM 144; CESIUM 137; EXTERNAL ZONES; FALLOUT; FUEL PARTICLES; RADIOISOTOPES; RUTHENIUM 106; SOILS

33814 (LA-UR–93-2934) **Uranium speciation in Fernald soils: Progress report, October 1, 1992–May 31, 1993: Revision 1.** Donohoe, R.J.; Morris, D.E.; Musgrave, J.A.; Tait, C.D.; Conradson, S.D. Los Alamos National Lab., NM (United States). 16 Jul 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93040098. Source: OSTI; NTIS; INIS; GPO Dep.

This interim progress report describes new experimental data collected from October 1, 1992 through May 31, 1993 as part of the Characterization Task of the Uranium in Soils Integrated Demonstration of the Office of Technology Development, Office of Environmental Restoration and Waste Management of the United States Department of Energy. X-ray absorption and optical luminescence spectroscopies have been used to analyze the uranium remaining in contaminated soils from the Fernald site after these samples were treated by various decontamination technologies under development within this Integrated Demonstration. The treatment technologies included soil washes with carbonate, citrate, Tiron, and Tiron/dithionite mixtures. The effectiveness of these procedures is discussed in a separate report from the Decontamination Task group. The characterization results indicate that following the application of all of these treatment strategies the uranium remaining in the soil is still best characterized as being primarily in the hexavalent oxidation state. However, for the A-series soils from the Incinerator Area, the speciation of this remaining uranium is different than seen previously based on the x-ray absorption data. The luminescence data for these treated soils also demonstrate that there is a decrease in size and quantity of the particulate hexavalent uranium that gives rise to the structured green emission. Thus, all treatment technologies do seem to generate a more dispersed, finer-grained form of uranium. For several treated samples a characteristic luminescence signal was found indicative of a schoepite phase of uranium. New results are also reported for untreated Fernald soil samples and reference uranium mineral phases.

33815 (LA-UR–93-2935) **Uranium speciation in Fernald soils: Progress report, January 1–May 31, 1992.** Morris, D.E.; Conradson, S.D.; Tait, C.D.; Chisholm-Brause, C.J.; Berg, J.; Musgrave, J. Los Alamos National Lab., NM (United States). 31 May 1992. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93040097. Source: OSTI; NTIS; INIS; GPO Dep.

This report details progress made from January 1 to May 31, 1992 in this analytical support task to determine the speciation of uranium in contaminated soil samples from the Fernald Environmental Management Project site under the auspices of the Uranium in Soils Integrated Demonstration funded through the US DOE's Office of Technology Development. The authors' efforts have focused on characterization of soil samples collected by S.Y. Lee (Oak Ridge National Laboratory) from five locales at the Fernald site. These were chosen to sample a broad range of uranium source terms. On the basis of x-ray absorption spectroscopy data, they have determined that the majority of uranium (> 80–90%) exists in the hexavalent oxidation state for all samples examined. This is a beneficial finding from the perspective of remediation, because U(VI) species are more soluble in general than uranium species in other oxidation states. Optical luminescence data from many of the samples show the characteristic structured yellow-green emission from the uranyl (UO_2^{2+}) moiety. The luminescence data also suggest that much of the uranium in these soils is present as well-crystallized UO_2^{2+} species. Some clear spectroscopic distinctions have been noted for several samples that illustrate significant differences in the speciation (1) from site to site, (2) within different horizons at the same site, and (3) within different size fractions of the soils in the same horizon at the same site. This marked heterogeneity in uranyl speciation suggests that several soil washing strategies may be necessary to reduce the total uranium concentrations within these soils to regulatory limits.

33816 (LBL–33984) **Heterogeneous slip and rupture models of the San Andreas fault zone based upon three-dimensional earthquake tomography.** Foxall, W. Lawrence Berkeley Lab., CA (United States). Nov 1992. 178p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93015037. Source: OSTI; NTIS; GPO Dep.

Crystal fault zones exhibit spatially heterogeneous slip behavior at all scales, slip being partitioned between stable frictional sliding, or fault creep, and unstable earthquake rupture. An understanding the mechanisms underlying slip segmentation is fundamental to research into fault dynamics and the physics of earthquake generation. This thesis investigates the influence that large-scale

along-strike heterogeneity in fault zone lithology has on slip segmentation. Large-scale transitions from the stable block sliding of the Central 4D Creeping Section of the San Andreas, fault to the locked 1906 and 1857 earthquake segments takes place along the Loma Prieta and Parkfield sections of the fault, respectively, the transitions being accomplished in part by the generation of earthquakes in the magnitude range 6 (Parkfield) to 7 (Loma Prieta). Information on sub-surface lithology interpreted from the Loma Prieta and Parkfield three-dimensional crustal velocity models computed by Michelini (1991) is integrated with information on slip behavior provided by the distributions of earthquakes located using, the three-dimensional models and by surface creep data to study the relationships between large-scale lithological heterogeneity and slip segmentation along these two sections of the fault zone.

33817 (NUREG/CP–0040, pp. 43-53) **Does the wind blow through Yucca Mountain?.** Weeks, E.P. (Geological Survey, Denver, CO (US)). Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Southwest Research Inst., San Antonio, TX (United States). Center for Nuclear Waste Regulatory Analyses; Arizona Univ., Tucson, AZ (United States). Dept. of Hydrology and Water Resources. Jun 1993. (CONF-9101106–: 5. flow and transport through unsaturated fractured rock related to high-level radioactive waste disposal, Tucson, AZ (United States), 7-10 Jan 1991). In *Proceedings of workshop 5: Flow and transport through unsaturated fractured rock – related to high-level radioactive waste disposal.* 238p. Source: OSTI; NTIS; INIS; GPO.

Beginning in February 1986, substantial net discharge of rock gas has been observed from a well located on the crest of Yucca Mountain that taps unsaturated fractured rock. Until recently, this net discharge was attributed entirely to a density contrast between slightly geothermally heated water vapor saturated rock gas and cooler, much drier atmospheric air. However, the net discharge is too large to be explained by the temperature and water vapor induced density contrast alone. A portion of this excess flow is now attributed to a wind effect. Hypothetically, as the wind blows against the mountain, the pressure increases along the flank due to a bluff or form-drag effect, and decreases at its crest due to an airfoil effect. This paper further examines the possibility of a wind effect on airflow from wells on Yucca Mountain. 9 refs., 3 figs., 1 tab.

33818 (ORNL/GWPO–003) **The deep hydrogeologic flow system underlying the Oak Ridge Reservation.** Nativ, R. (Hebrew Univ., Jerusalem (IL)); Hunley, A.E. Oak Ridge National Lab., TN (United States). Jul 1993. 41p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93019601. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication 4097.

The deep hydrogeologic system underlying the Oak Ridge Reservation contains some areas contaminated with radionuclides, heavy metals, nitrates, and organic compounds. The groundwater at that depth is saline and has previously been considered stagnant. On the basis of existing and newly collected data, the nature of flow of the saline groundwater and its potential discharge into shallow, freshwater systems was assessed. Data used for this purpose included (1) spatial and temporal pressures and hydraulic heads measured in the deep system, (2) hydraulic parameters of the formations in question, (3) spatial temperature variations, and (4) spatial and temporal chemical and isotopic composition of the saline groundwater. In addition, chemical analyses of brine in adjacent areas in Tennessee, Kentucky, Ohio, Pennsylvania, and West Virginia were compared with the deep water underlying the reservation to help assess the origin of the brine. Preliminary conclusions suggest that the saline water contained at depth is old but not isolated (in terms of recharge and discharge) from the overlying active and freshwater-bearing units. The confined water (along with dissolved solutes) moves along open fractures (or man-made shortcuts) at relatively high velocity into adjacent, more permeable units. Groundwater volumes involved in this flow probably are small.

33819 (ORNL/NERP–8) **Resource management plan for the Oak Ridge Reservation: Volume 30, Oak Ridge National Environmental Research Park natural areas and reference areas–Oak Ridge Reservation environmentally sensitive sites containing special plants, animals, and communities.** Pounds, L.R. (Univ. of Tennessee, Knoxville, TN (US)); Parr, P.D.; Ryon, M.G. Oak Ridge National Lab., TN (United States). Aug 1993. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93040333. Source: OSTI; NTIS; GPO Dep.

Environmental Sciences Division Publication No. 3995.

Areas on the Oak Ridge Reservation (ORR) that contain rare plant or animal species or are special habitats are protected through National Environmental Research Park Natural Area (NA) or Reference Area (RA) designations. The US Department of Energy's Oak Ridge National Environmental Research Park program is responsible for identifying species of vascular plants that are endangered, threatened, or rare and, as much as possible, for conserving those areas in which such species grow. This report includes a listing of Research Park NAs and RAs with general habitat descriptions and a computer-generated map with the areas identified. These are the locations of rare plant or animal species or special habitats that are known at this time. As the Reservation continues to be surveyed, it is expected that additional sites will be designated as Research Park NAs or RAs. This document is a component of a larger effort to identify environmentally sensitive areas on ORR. This report identifies the currently known locations of rare plant species, rare animal species, and special biological communities. Floodplains, wetlands (except those in RAs or NAs), and cultural resources are not included in this report.

33820 (ORNL/TM–12217) **Pilot uranium lysimeter studies at the Oak Ridge Y-12 plant.** Francis, C.W.; Hyder, L.K.; Howard, S.C.; Cline, J.E.; Clapp, R.B. Oak Ridge National Lab., TN (United States). Aug 1993. 76p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93019361. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Divison Publication No. 3981.

A field lysimeter test facility has been constructed at the Oak Ridge Y-12 plant to evaluate land burial of wastes containing depleted uranium. The principal objective in the construction of such a facility is to provide a means for monitoring waste leachate characteristics over time, in particular uranium concentrations in leachate. The design of the field lysimeter test facility allows, via the portals along the side walls of the lysimeter, the collection of leachate as a function of depth in the lysimeter. The methodology to collect leachate from within the field lysimeter has not been clearly defined. Thus, before wastes were loaded into the field lysimeter facility, a pilot lysimeter study was initiated to test several design concepts for the collection of in situ leachate. The primary objective of this pilot study was to demonstrate the feasibility and quality assurance of proposed instrumentation used to monitor leachate generation and characteristics in the full-scale field lysimeter. Secondary objectives included gaining experience in the handling/packing of wastes, installation/operation of the leachate collection devices, and waste leachate characterization.

33821 (ORNL/TM–12225) **Radiological survey results at the former Bridgeport Brass Company facility, Seymour, Connecticut.** Foley, R.D.; Carrier, R.F. Oak Ridge National Lab., TN (United States). Jun 1993. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93017987. Source: OSTI; NTIS; INIS; GPO Dep.

At the request of the US Department of Energy (DOE), a team from Oak Ridge National Laboratory conducted a radiological survey of the former Bridgeport Brass Company facility, Seymour, Connecticut. The survey was performed in May 1992. The purpose of the survey was to determine if the facility had become contaminated with residuals containing radioactive materials during the work performed in the Ruffert building under government contract in the 1960s. The survey included a gamma scanning over a circumscribed area around the building, and gamma and beta-gamma scanning over all indoor surfaces as well as the collection of soil and other samples for radionuclide analyses. Results of the survey demonstrated radionuclide concentrations in indoor and outdoor samples, and radiation measurements over floor and wall surfaces, in excess of the DOE Formerly Utilized Sites Remedial Action Program guidelines. Elevated uranium concentrations outdoors were limited to several small, isolated spots. Radiation measurements

exceeded guidelines indoors over numerous spots and areas inside the building, mainly in Rooms 1–6 that had been used in the early government work.

33822 (ORNL/TM–12260) **X-231B technology demonstration for in situ treatment of contaminated soil: Laboratory evaluation of in situ vapor stripping.** West, O.R. (Oak Ridge National Lab., TN (US)); Siegrist, R.L.; Jennings, H.L.; Lucero, A.J.; Greene, D.W.; Schmunk, S.W. Oak Ridge National Lab., TN (United States). Jun 1993. 99p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93019397. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 4105.

The goal of the study described in this report was to determine the efficiency of vapor stripping coupled with soil mixing for removing volatile organic compounds (VOCs) from clay soils such as those that underlie the PORTS X-231B Solid Waste Management Unit. This was accomplished by conducting experiments wherein contaminated soil cores were treated in the laboratory using a system that simulated a field-scale vapor stripping/soil mixing treatment process. Treatment efficiencies obtained using several sets of process conditions, such as air temperature and flow rate, were determined through subsampling of the soil cores to establish pre- and posttreatment levels of VOCs in the soil. Two series of experiments were conducted under this study. In the first series, laboratory treatment was performed on intact soil cores that were taken from contaminated zones within the PORTS X-231B Unit using sampler liners that could be adapted as reaction lysimeters. Since soil core disturbance was minimized using this approach, the treatability experiments were conducted on soil that was fairly close to in situ conditions in terms of both soil structure and contaminant levels. The second series of experiments were performed on cores that were packed using X-231B soil and spiked with known amounts of trichloroethylene (TCE). This approach was taken for the second series because the VOC levels in the intact cores were found to be much lower than field values. In addition, the packed cores were smaller than the intact soil cores, with treatment volumes that were about a fifth of the treatment volumes in the intact soil cores. The smaller packed cores were not only easier to handle but were also more reliably characterized due to smaller treatment volumes from which samples were taken.

33823 (ORNL/TM–12317) **In situ treatment of VOCs by recirculation technologies.** Siegrist, R.L. (Oak Ridge National Lab., TN (US)); Webb, O.F.; Ally, M.R.; Sanford, W.E.; Kearl, P.M.; Zutman, J.L. Oak Ridge National Lab., TN (United States). Jun 1993. 110p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93017850. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication No. 4056.

The project described herein was conducted by Oak Ridge National Laboratory (ORNL) to identify processes and technologies developed in Germany that appeared to have near-term potential for enhancing the cleanup of volatile organic compound (VOC) contaminated soil and groundwater at DOE sites. Members of the ORNL research team identified and evaluated selected German technologies developed at or in association with the University of Karlsruhe (UoK) for in situ treatment of VOC contaminated soils and groundwater. Project activities included contacts with researchers within three departments of the UoK (i.e., Applied Geology, Hydromechanics, and Soil and Foundation Engineering) during fall 1991 and subsequent visits to UoK and private industry collaborators during February 1992. Subsequent analyses consisted of engineering computations, groundwater flow modeling, and treatment process modeling. As a result of these project efforts, two processes were identified as having near-term potential for DOE: (1) the vacuum vaporizer well/groundwater recirculation well and (2) the porous pipe/horizontal well. This document was prepared to summarize the methods and results of the assessment activities completed during the initial year of the project. The project is still ongoing, so not all facets of the effort are completely described in this document. Recommendations for laboratory and field experiments are provided.

33824 (PNL–8662) **Arid site characterization and technology assessment: Volatile Organic Compounds-Arid Integrated Demonstration.** Riley, R.G. Pacific Northwest Lab., Richland, WA (United States). Jun 1993. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93016708. Source: OSTI; NTIS; GPO Dep.

The US Department of Energy's (DOE's) Volatile Organic Compounds-Arid Integrated Demonstration (VOC-Arid ID) program was initiated in March 1991 to evaluate technologies for all phases of remediation of VOCs in soils and groundwater at DOE arid/semiarid sites. The primary site for field demonstrations under the VOC-Arid ID program is the Hanford Site. The purpose of this report is to describe (1) the bases for technologies currently under evaluation in the VOC-Arid ID program; (2) the types of subsurface contamination at DOE arid/semiarid sites; and (3) the areas of potential common technology interests based on perceived technology needs at other DOE sites. This report was compiled by Pacific Northwest Laboratory in response to DOE's Office of Technology Development's mission to carry out an aggressive program to accelerate the development and implementation of new and existing technologies to meet a 30-year goal set by DOE in June 1989 to clean up all of its sites and to bring all sites into compliance with current and future environmental regulations. A key component of this program is the development of technologies that are better, faster, safer, and cheaper than those technologies currently available. Included in this report are an evaluation of technologies currently (fiscal year 1993) being pursued at the Hanford Site under the auspices of the VOC-Arid ID program, an assessment of subsurface contaminants at arid/semiarid sites, a summarization of technologies under consideration at other DOE sites, a discussion of areas of potential common technology interests, and the conclusions. Also included are a summary of the extent of contamination at the DOE arid/semiarid sites under consideration and a bibliography of source documents from which this report was prepared.

33825 (PNL–8676) **Hanford Cultural Resources Laboratory annual report for fiscal year 1992.** Chatters, J.C.; Gard, H.A.; Wright, M.K.; Crist, M.E.; Longenecker, J.G.; O'Neil, T.K.; Dawson, M.V. Pacific Northwest Lab., Richland, WA (United States). Jun 1993. 113p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93017231. Source: OSTI; NTIS; GPO Dep.

The Hanford Cultural Resources Laboratory (HCRL) was established by the US Department of Energy, Richland Field Office (RL) in 1987 as part of Pacific Northwest Laboratory (PNL). The HCRL provides support for managing the archaeological, historical, and cultural resources of the Hanford Site located in southcentral Washington, in a manner consistent with the National Historic Preservation Act Amended 1992 (NBPA), the Archaeological Resources Protection Act of 1979 (ARPA), the Native American Grave Protection and Repatriation Act of 1990 (NAGPRA), and the American Indian Religious Freedom Act of 1978 (AIRFA). The HCRL responsibilities have been set forth in the Hanford Cultural Resources Management Plan as a prioritized list of tasks to be undertaken to keep the RL in compliance with federal statutes, regulations, and guidelines. For FY 1992, these tasks were to (1) ensure compliance with NBPA Section 106, (2) monitor the condition of known archaeological sites, (3) evaluate cultural resources for potential nomination to the National Register of Historic Places, (4) educate the public about cultural resources, and (5) conduct a sample archaeological survey of Hanford lands. Research was also conducted as a spin-off of these tasks and is also reported here.

33826 (PNL-SA–21625) **In situ stimulation vs. bioaugmentation: Can microbial inoculation of plant roots enhance biodegradation of organic compounds?.** Kingsley, M.T. (Pacific Northwest Lab., Richland, WA (United States)); Metting, F.B. Jr.; Fredrickson, J.K.; Seidler, R.J. Pacific Northwest Lab., Richland, WA (United States). Jun 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930647–6: 86. annual meeting and exhibition of the Air and Waste Management Association (AWMA), Denver, CO (United States), 13-18 Jun 1993). Order Number DE93017218. Source: OSTI; NTIS; GPO Dep.

The use of plant roots and their associated rhizosphere bacteria for biocontainment and biorestoration offers several advantages for treating soil-dispersed contaminants and for application to large

land areas. Plant roots function as effective delivery systems, since root growth transports bacteria vertically and laterally along the root in the soil column (see [1,2]). Movement of microbes along roots and downward in the soil column can be enhanced via irrigation [1-4]. For example, Ciafardini et al. [3] increased the nodulation and the final yield of soybeans during pod filling by including Bradyrhizobium japonicum in the irrigation water. Using rhizosphere microorganisms is advantageous for biodegradation of compounds that are degraded mainly by cometabolic processes, e.g., trichloroethylene (TCE). The energy source for bacterial growth and metabolism is supplied by the plant in the form of root exudates and other sloughed organic material. Plants are inexpensive, and by careful choice of species that possess either tap or fibrous root growth patterns, they can be used to influence mass transport of soil contaminants to the root surface via the transpiration stream [5]. Cropping of plants to remove heavy metals from contaminated soils has been proposed as a viable, low-cost, low-input treatment option [6]. The interest in use of plants as a remediation strategy has even reached the popular press [7], where the use of ragweed for the reclamation of sites contaminated with tetraethyl lead and other heavy metals was discussed.

33827 (UCRL-ID–104740) **Beryllium in soils of the Nevada Test Site: A preliminary assessment.** Patton, S.E. Lawrence Livermore National Lab., CA (United States). Jul 1992. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93016951. Source: OSTI; NTIS; GPO Dep.

A preliminary assessment of the occurrence and distribution of beryllium in soils of the Nevada Test Site (NTS) was conducted by identifying sites on the NTS where beryllium might have been used in past operations and measuring current soil beryllium concentrations at those sites. Eighty-one soil samples were collected from six sites on the NTS. The six sites were chosen after interviews with persons who are or were involved with NTS operations and stated that beryllium might have been used in operations at those sites. The soil samples were prepared for analysis using EPA procedures and analyzed by flame-atomic-absorption spectrophometry. Beryllium concentrations in the soil samples ranged from the analytical detection limit of 0.46 parts-per-million (ppM) to 4.65 ppM. The beryllium concentrations in NTS soils may be higher than estimated local background soil beryllium concentrations, but in concentrations that fall within the range found in surface soils of the United States. Air beryllium concentrations were conservatively estimated to be considerably lower than regulatory exposure limits. Further work is recommended in assessing the spatial distribution of beryllium in soils around several of the sites, with a sampling design that incorporates statistical procedures to ensure statistically valid results.

33828 (UCRL-JC–109902) **Dynamic Underground Stripping Project.** Aines, R. (Lawrence Livermore National Lab., CA (United States)); Newmark, R.; McConachie, W.; Udell, K.; Rice, D.; Ramirez, A.; Siegel, W.; Buettner, M.; Daily, W.; Krauter, P.; Folsom, E.; Boegel, A.J.; Bishop, D.; Udell, K. Lawrence Livermore National Lab., CA (United States). Jan 1992. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920307–94: Waste management '92, Tucson, AZ (United States), 1-5 Mar 1992). Order Number DE93013133. Source: OSTI; NTIS; INIS; GPO Dep.

LLNL is collaborating with the UC Berkeley College of Engineering to develop and demonstrate a system of thermal remediation and underground imaging techniques for use in rapid cleanup of localized underground spills. Called "Dynamic Stripping" to reflect the rapid and controllable nature of the process, it will combine steam injection, direct electrical heating, and tomographic geophysical imaging in a cleanup of the LLNL gasoline spill. In the first 8 months of the project, a Clean Site engineering test was conducted to prove the field application of the techniques before moving the contaminated site in FY 92.

33829 (UCRL-JC–113731) **A new fiber-optic sensor technology for rapid and inexpensive characterization of soil contamination.** Milanovich, F.P. (Lawrence Livermore National Lab., CA (United States)); Brown, S.B.; Colston, B.W. Jr.; Daley, P.F.; Rossabi, J. Lawrence Livermore National Lab., CA (United States). Apr 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930589–4: 4. international conference on contaminated soil, Berlin (Germany), 3-7 May 1993). Order Number DE93017973. Source: OSTI; NTIS; INIS; GPO Dep.

The extent and complexity of worldwide environmental contamination are great enough that remediation will be extremely costly and lengthy. There is an urgent need for characterization techniques that are rapid, inexpensive, and simple and that do not generate waste. Towards this end LLNL is developing a fiber-optic chemical sensor technology for use in groundwater and vadose-zone monitoring. We use a colorimetric detection technique, based on an irreversible chemical reaction between a specific reagent and the target compound. The accuracy and sensitivity of the sensor (<5 ppb by weight in water, determined by comparison with gas chromatographic standard measurements) are sufficient for environmental monitoring of at least trichloroethylene (TCE) and chloroform.

33830 (WHC-EP–0595) **Westinghouse Hanford Company Operational Groundwater status report, 1990–1992.** Johnson, V.G. Westinghouse Hanford Co., Richland, WA (United States). Mar 1993. 509p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93017594. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents information related to the water quality of ground water at the Hanford Reservation. Included are plume maps, geology, hydrology, and information on various effluent sources.

33831 (WHC-SD-EN-AP–129-Rev.1) **Description of work for the 200-UP-1 groundwaters contaminant vertical profiling activity: Revision 1.** Ford, B.H. Westinghouse Hanford Co., Richland, WA (United States). 28 Jul 1993. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018741. Source: OSTI; NTIS; GPO Dep.

This description of work (DOW) details the field activities associated with assessing the vertical extent of groundwater contamination in the uppermost unconfined and confined aquifers beneath the southeastern portion of the 200 West area. The document serves as the test plan for those performing the work. It should be used in conjunction with the Remedial Investigation/ Feasibility Study Work Plan for the 200-UP-1 Groundwater Operable Unit, Hanford Site, Richland, Washington (200-UP-1 Operable Unit Workplan) (DOE/RL 1991) for general investigation strategy and with specific procedures. Work scope for the vertical profiling activity is defined in sections 4.2 and 5.1.3 of the 200-UP-1 Operable Unit Workplan. The work is one portion of a proposed Limited Field Investigation (LFI) data collection program.

33832 (WHC-SD-EN-TI–110) **QA/QC requirements for physical properties sampling and analysis.** Innis, B.E. Westinghouse Hanford Co., Richland, WA (United States). 21 Jul 1993. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018745. Source: OSTI; NTIS; GPO Dep.

This report presents results of an assessment of the available information concerning US Environmental Protection Agency (EPA) quality assurance/quality control (QA/QC) requirements and guidance applicable to sampling, handling, and analyzing physical parameter samples at Comprehensive Environmental Restoration, Compensation, and Liability Act (CERCLA) investigation sites. Geotechnical testing laboratories measure the following physical properties of soil and sediment samples collected during CERCLA remedial investigations (RI) at the Hanford Site: moisture content, grain size by sieve, grain size by hydrometer, specific gravity, bulk density/porosity, saturated hydraulic conductivity, moisture retention, unsaturated hydraulic conductivity, and permeability of rocks by flowing air. Geotechnical testing laboratories also measure the following chemical parameters of soil and sediment samples collected during Hanford Site CERCLA RI: calcium carbonate and saturated column leach testing. Physical parameter data are used for (1) characterization of vadose and saturated zone geology and hydrogeology, (2) selection of monitoring well screen sizes, (3) to support modeling and analysis of the vadose and saturated zones, and (4) for engineering design. The objectives of this report are to

determine the QA/QC levels accepted in the EPA Region 10 for the sampling, handling, and analysis of soil samples for physical parameters during CERCLA RI.

33833 (WHC-SD-EN-TI-171) **Electronic cone penetration testing at the Hanford Site, 200 West Area.** Rohay, V.J. Hanford Engineering Development Lab., Richland, WA (United States). 4 Jun 1993. 65p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93018746. Source: OSTI; NTIS; GPO Dep.

The 200 West Area Carbon Tetrachloride Expedited Response Action (ERA) is being conducted by the US Department of Energy (DOE) at the direction of the US Environmental Protection Agency (EPA) and the Washington Department of Ecology as a provision of both the Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA) and the Integrated Demonstration for Cleanup of Volatile Organic Compounds at Arid Sites (VOC-Arid ID). The ERA allows expedited response to be taken at waste sites where damage to the environment can be significantly reduced by early action to locate, identify the extent, and remediate imminent hazards. The ERA is focusing specifically on the removal of carbon tetrachloride vapor from the soil column and protection of the groundwater in the 200 West Area. The VOC-Arid ID program allows demonstration of new drilling technologies for environmental characterization monitoring and remediation. Soil vapor vacuum extraction has been proposed to remediate the site. This may require vapor extraction wells to be installed within the plume.

33834 (WSRC-MS-93-361) **Applications of Quaternary stratigraphic, soil-geomorphic, and quantitative geomorphic analyses to the evaluation of tectonic activity and landscape evolution in the Upper Coastal Plain, South Carolina.** Hanson, K.L. (Geomatrix Consultants, Inc., San Francisco, CA (United States)); Bullard, T.F.; de Wit, M.W.; Stieve, A.L. Westinghouse Savannah River Co., Aiken, SC (United States). [1993]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-9310102--1: 4. energy natural phenomena hazards mitigation conference, Atlanta, GA (United States), 19-22 Oct 1993). Order Number DE93016269. Source: OSTI; NTIS; GPO Dep.

Geomorphic analyses combined with mapping of fluvial terraces and upland geomorphic surfaces provide new approaches and data for evaluating the Quaternary activity of post-Cretaceous faults that are recognized in subsurface data at the Savannah River Site in the Upper Coastal Plain of southwestern South Carolina. Analyses of longitudinal stream and terrace profiles, regional slope maps, and drainage basin morphometry indicate long-term uplift and southeast tilt of the site region. Preliminary results of drainage basin characterization suggests an apparent rejuvenation of drainages along the trace of the Pen Branch fault (a Tertiary reactivated reverse fault that initiated as a basin-margin normal fault along the northern boundary of the Triassic Dunbarton Basin). This apparent rejuvenation of drainages may be the result of nontectonic geomorphic processes or local tectonic uplift and tilting within a framework of regional uplift.

33835 (WSRC-RP-93-0723) **Estimation of Ni^{63}, Pu^{241}, Pu^{242} and Am^{243} from Co^{60}, Pu^{239}, and Cm^{244} activities in groundwater samples.** Holcomb, H.P. Westinghouse Savannah River Co., Aiken, SC (United States). 14 May 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93018774. Source: OSTI; NTIS; INIS; GPO Dep.

The Part B Permit for F&H Seepage Basins calls for analysis of several constituents of concern in groundwater monitoring wells. Four of these analytes are the radionuclides Ni^{63}, Pu^{241}, Pu^{242}, and Am^{243}. These are currently not being analyzed due to their very difficult, tedious analytical schemes coupled with their relatively low activity values. This report demonstrates how the activity value for Ni^{63}, a week beta emitter, can be estimated from that of Co^{60}, an easily detectable, high-energy gamma emitter. Similarly, estimates of Pu^{241}, a beta emitter, and the alpha-emitting Pu^{242} can be made from the activity value of the more easily detected Pu^{239}. Am^{243} can be estimated from the activity of Cm^{244}, which is easier to detect because of a shorter half-life (higher specific activity) and the emission of higher energy alpha particles. These correlations are made under very specific parameters in order to ensure the validity of this approach. Therefore, assumptions must be established setting ground rules for establishing these activity relationships. Bases for these assumptions are explained and/or referenced. Their degree of uncertainty limits the accuracy of the data so that the term "estimate" is used. Such soundly-based, conservative estimates for these four rads can provide a tool for evaluating any hazards from their presence over the next several years. Hopefully, during this time, sufficient advances will be made in their radiochemical analyses and in counting techniques so that in the future, their activities may be quantitatively determined more easily and also more cost effectively.

33836 (WSRC-TR-93-273) **F- and H-Area Sewage Sludge Application Sites groundwater monitoring report.** Westinghouse Savannah River Co., Aiken, SC (United States). Jul 1993. 66p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93019839. Source: OSTI; NTIS; GPO Dep.

Samples from the four wells at the F-Area Sewage Sludge Application Site (FSS wells) and the three wells at the H-Area Sewage Sludge Application Site (HSS wells) are analyzed quarterly for constituents as required by South Carolina Department of Health and Environmental Control Construction Permit 12,076 and, as requested, for other constituents as part of the Savannah River Site Groundwater Monitoring Program. Annual analyses for other constituents, primarily metals, also are required by the permit. Historically and currently, no permit-required analytes exceed standards at the F- and H-Area Sewage Sludge Application Sites except iron, lead, and manganese, which occur in elevated concentrations frequently in FSS wells and occasionally in HSS wells. Tritium and aluminum are the primary nonpermit constituents that exceed standards at the F-Area Sewage Sludge Application Site. Other constituents also exceed standards at this site but only sporadically.

33837 (WSRC-TR-93-275) **F-Area Acid/Caustic Basin Groundwater Monitoring Report: First quarter 1993.** Westinghouse Savannah River Co., Aiken, SC (United States). Jun 1993. 72p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93019834. Source: OSTI; NTIS; GPO Dep.

During first quarter 1993, samples from the six FAC monitoring wells at F-Area Acid/Caustic Basin were analyzed for indicator parameters, groundwater quality parameters, parameters indicating suitability as drinking water, and other constituents. Monitoring results that exceeded the final Primary Drinking Water Standards (PDWS) or the Savannah River Site (SRS) flagging criteria or turbidity standard during the quarter are the focus of this report. Dichloromethane exceeded the final PDWS in four wells, including upgradient well FAC 3. Gross alpha exceeded the final PDWS in three wells, including upgradient well FAC 3. Aluminum and iron each exceeded Flag 2 criteria in five of the six wells. Total organic halogens exceeded the Flag 2 criterion in three wells, manganese in two, and total alpha-emitting radium, total organic carbon, and lead in one each. Turbidity exceeded the SRS standard in well FAC 3.

33838 (WSRC-TR-93-276) **H-Area Acid/Caustic Basin groundwater monitoring report.** Westinghouse Savannah River Co., Aiken, SC (United States). Jun 1993. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93019835. Source: OSTI; NTIS; GPO Dep.

During first quarter 1993, samples from the four HAC monitoring wells at the H-Area Acid/Caustic Basin received comprehensive analyses. Monitoring results that exceeded the final Primary Drinking Water Standards (PDWS) or the Savannah River Site (SRS) flagging criteria or turbidity standard during the quarter are the focus of this report. Tritium exceeded the final PDWS only in well HAC 1 during first quarter 1993. Aluminum exceeded its Flag 2 criterion in wells HAC 2, 3, and 4. Iron was elevated in well HAC 1, 2, and 3. No well samples exceeded the SRS turbidity standard.

33839 (WSRC-TR–93-277) **K-Area Acid/Caustic Basin groundwater monitoring report: First quarter 1993.** Westinghouse Savannah River Co., Aiken, SC (United States). Jun 1993. 64p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93019613. Source: OSTI; NTIS; GPO Dep.

During first quarter 1993, samples from the KAC monitoring wells at the K-Area Acid/Caustic Basin were analyzed for indicator parameters, groundwater quality parameters, parameters indicating suitability as drinking water, and other constituents. Wells KAC 8 and 9 also were sampled for GC/MS VOA (gas chromatograph/mass spectrometer volatile organic analyses). Monitoring results that exceeded the final Primary Drinking Water Standards (PDWS) or the Savannah River Site (SRS) flagging criteria or turbidity standard during the quarter are discussed in this report. Aluminum exceeded its Flag 2 criterion in wells KAC 6, 7, 8, and 9. Iron exceeded the Flag 2 criterion in wells KAC 6, 7, and 8, lead was elevated in well KAC 7, and specific conductance exceeded the Flag 2 criterion in well KAC 9. No samples exceeded the SRS turbidity standard.

33840 (WSRC-TR–93-278) **P-Area Acid/Caustic Basin groundwater monitoring report: First quarter 1993.** Westinghouse Savannah River Co., Aiken, SC (United States). Jun 1993. 60p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93019829. Source: OSTI; NTIS; GPO Dep.

During first quarter 1993, samples from the six PAC monitoring wells at the P-Area Acid/Caustic Basin were analyzed for indicator parameters, groundwater quality parameters, and parameters characterizing suitability as a drinking water supply. Monitoring results that exceeded the final Primary Drinking Water Standards (PDWS) or the Savannah River Site (SRS) flagging criteria or turbidity standard during the quarter are discussed in this report. During first quarter 1993, no constituents exceeded the final PDWS. Aluminum exceeded the SRS Flag 2 criterion in four of the wells. Iron and manganese each exceeded its Flag 2 criterion in wells PAC 2, 5, and 6.

33841 (WSRC-TR–93-280) **Sanitary Landfill groundwater monitoring report: First quarter 1993.** Westinghouse Savannah River Co., Aiken, SC (United States). May 1993. 182p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93040069. Source: OSTI; NTIS; GPO Dep.

This report contains analytical data for samples taken during first quarter 1993 from wells of the LFW series located at the Sanitary Landfill at the Savannah River Site. The data are submitted in reference to the Sanitary Landfill Operating Permit (DWP-087A). The report presents monitoring results that equaled or exceeded the Safe Drinking Water Act final Primary Drinking Water Standards (PDWS) or screening levels, established by the US Environmental Protection Agency, the South Carolina final Primary Drinking Water Standards for lead or the SRS flagging criteria.

33842 (WSRC-TR–93-320) **Four Mile Creek semi-annual sampling report, January 1993 sampling event.** Westinghouse Savannah River Co., Aiken, SC (United States); Metcalf and Eddy, Inc., Wakefield, MA (United States). May 1993. 77p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93018772. Source: OSTI; NTIS; INIS; GPO Dep.

From 1955 to 1988 low-level radioactive wastewater generated by chemical separation processes within the General Separations Area (GSA) was discharged to seepage basins in the F and H Areas of the Savannah River Site (SRS). These basins were designed to permit the infiltration of the process wastewaters. As wastewater percolated downward through the basins, chemical and radioactive constituents were retained or sequestered in the subsoils. An extensive study aimed at characterizing the groundwater seeping into Four Mile Creek and its associated seepline was conducted in 1988 and 1989 (Haselow et al. 1990). Results of this study suggested that contaminants leaching from the F and H Area seepage basins were impacting the Four Mile Creek wetland system. The seepage basins were closed in 1988 and capped and sealed in 1990. This effectively eliminated the source of the contaminants and the hydraulic head driving the migration of contaminants from the basins. It has been hypothesized that, after the elimination of the source and head, annual rainfall amounts would be sufficient to dilute and flush out contaminants remaining in the subsoils and groundwaters beneath the basins. Westinghouse Savannah River Company has designed a semi-annual sampling and analytical program for the Four Mile Creek (FMC) seepline and stream water to test the hypothesis. This report summarizes field monitoring activities from January 25, 1993 to February 4, 1993.

5403 Environmental Sciences, Aquatic

Refer also to citation(s) 32307, 32393, 32416, 32538, 32550, 32552, 32570, 32680, 32681, 32913, 33061, 33292, 33294, 33755, 33759, 33766, 33773, 33785, 33804, 33805, 33809, 33842, 33919, 33970

33843 (DOE/BP/21985–2) **Modified streamflows 1990 level of irrigation: Missouri, Colorado, Peace and Slave River Basin, 1928–1989.** USDOE Bonneville Power Administration, Portland, OR (United States); Crook (A.G.) Co., Beaverton, OR (United States). Jul 1993. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC79-92BP21985. Order Number DE93019486. Source: OSTI; NTIS; GPO Dep.

This report presents data for monthly mean streamflows adjusted for storage change, evaporation, and irrigation, for the years 1928-1990, for the Colorado River Basin, the Missouri River Basin, the Peace River Basin, and the Slave River Basin.

33844 (DOE/FTR–93015192) **Meeting in Austria on the validation of models for predicting radionuclide transfer in terrestrial, aquatic, and urban environments: Foreign trip report, February 29–March 7, 1992.** Napier, B.A. Pacific Northwest Lab., Richland, WA (United States). 2 Apr 1992. 28p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93015192. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This was the fourth annual meeting of the coordinated research program on the validation of dose assessment models using data derived from the Chernobyl accident. The four working groups; terrestrial, aquatic, urban, and multiple pathways, each presented on their progress in the last year. A number of draft documents dealing with important aspects of radionuclide behavior were circulated. A one-day plenary session was held Tuesday devoted to exploring current capabilities for predicting the fate of deposited radionuclides, with some special emphasis on urban environments. The traveller presented a data set derived from Hanford Site historic measurements for use as the basis for a Multiple Pathways working group validation set. This was accepted, and a scenario for distribution to the group is going to be prepared.

33845 (ETDE-IT–93-206) **Discrete stochastic models in dynamics of size-structured population.** Buffoni, G. (ENEA, La Spezia (Italy). Centro Ricerche Energia Ambiente Santa Teresa - Area Energia Ambiente e Salute); Di Cola, G. 1993. 20p. (CONF-9206358–2: 3. international conference on mathematical population dynamics, Pau (France), 1-5 Jun 1992). Order Number DE93522958. Source: OSTI; NTIS (US Sales Only).

The dynamics of a size-structured population is described as a generalized nonlinear Leslie model, through a discrete analog of the forward Kolmogorov equation. The steady state solution of a difference equation system is the positive eigenvalutation corresponding to the unit eigenvalue of a nonlinear eigenvalue problem in k_n. Necessary and sufficient conditions of the existence and uniqueness of the steady state solutions are given. An algorithm for computing this solution is described. Local stability around the equilibrium was also studied. As a case study, an application to a red coral population is considered.

33846 (FEMP/SUB–066) **Electrofishing survey of the Great Miami River, September 1992: Annual report.** Miller, M.C. (Cincinnati Univ., OH (United States). Dept. of Biological Sciences); Bixby, R.; Engman, J.; Ross, L.; Stocker, L. Westinghouse Environmental Management Co. of Ohio, Cincinnati, OH (United States). Fernald Environmental Management Project; Cincinnati Univ., OH (United States). Dept. of Biological Sciences. Mar 1993.

78p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-86OR21600. Order Number DE93015654. Source: OSTI; NTIS; GPO Dep.

At the end of summer in 1992 the fishery of the Great Miami River took an unexpected deviation from the stasis of past years as an intense suspended algal bloom decreased the compositional diversity found at the lower GMR stations. Daytime supersaturation of oxygen and elevated pHs, reaching 9 by midday during the month of August, undoubtedly caused severe deficits of oxygen at night. Despite the aeration at every riffle, the intensities of the biological processes in the water were sufficient to cause very high positive and negative excursions of oxygen over the day and night cycle. This report documents a fish harvest that was conducted as part of the oxygen excess/deficit study.

33847 (INIS-JP–008, pp. 484-491) **Radioecological studies in the marine environment.** Suzuki, Y. (National Inst. of Radiological Sciences, Nakaminato, Ibaraki (Japan). Nakaminato Lab. Branch Office); Nakamura, K.; Nakamura, R.; Nakahara, M.; Ishii, T.; Matsuba, M.; Nagaya, Y. Japan Atomic Energy Research Inst., Tokyo (Japan). 1992. 558p. (CONF-9203223–: International conference on radiation effects and protection, Mito (Japan), 18-20 Mar 1992). In *Proceedings of the international conference on radiation effects and protection.* Order Number DE93764166. Source: OSTI; NTIS; INIS.

Man-made radionuclides released into the marine environment have been regarded as useful tracers in the study of natural geochemical and oceanographic processes occurring in the ocean. Quantitative collection of Cs-137 from surface seawater by copper ferrocyanide-anion exchange resin was examined and the same method was also applied to open ocean sea water. To get inherent bioconcentration coefficients of marine fish from the coastal seas of Japan, laboratory tracer experiments using some radioisotopes were carried out. Uptake, through both radioactive seawater and food, and excretion of radionuclides by marine fish were observed for about 8 weeks. The results showed that seawater and food equally contribute to accumulation of Cs-137 by fish. The adult rockfish and Japanese flounder seemed to take up Ru-103 mainly from seawater, while juvenile fish take it from seawater and food equally. Much information on concentrations, distributions and chemical forms of stable isotopes in marine organisms is important to predict the behaviour of radionuclides in the sea or to study metal metabolism in the body of marine organisms. Approximately 40 elements corresponding to important radionuclides in more than 300 species of marine organisms, collected off the coast of Japan, were analyzed with ICP-AES, ICP-MS and electron probe X-ray microanalysis. The concentrations of Mn and Zn in the dried granules of the kidney of a marine bivalve were 44,200 and 22,800 μg/g, respectively. The high accumulation of certain elements in the kidney resulted from the existence of metal containing granules. (author).

33848 (LBL–32837) **Spatial and temporal variations in toxicity in a marsh receiving urban runoff.** Katznelson, R.; Jewell, W.T.; Anderson, S.L. Lawrence Berkeley Lab., CA (United States). Jun 1993. 66p. Sponsored by California State Government, Sacramento, CA (United States). DOE Contract AC03-76SF00098. Order Number DE93019099. Source: OSTI; NTIS; GPO Dep.

This project is composed of two sections. The first section describes dry weather toxicity surveys to evaluate the distribution of toxicity in the waters of San Francisco Bay and adjacent wetland habitat, and the second is a series of wet weather toxicity studies with emphasis on a marsh receiving urban runoff. The dry weather studies are reported in the appendices, while the wet weather work comprises the main report.

33849 (LBL–33532) **Hydrological and geochemical investigations of selenium behavior at Kesterson Reservoir: Annual report, October 1, 1990–September 30, 1992.** Benson, S.M.; Tokunaga, T.; Zawislanski, P.; Wahl, C.; Johannis, P.; Zavarin, M.; Yee, A.; Tsao, L.; Phillips, D.; Ita, S. Lawrence Berkeley Lab., CA (United States). Dec 1992. 242p. Sponsored by Department of the Interior, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93016714. Source: OSTI; NTIS; GPO Dep.

This report describes work carried out at Kesterson Reservoir by scientists and engineers from Lawrence Berkeley Laboratory over the two-year period from October 1990 to September 1992. Efforts described in this report include the following: Results from vadose zone monitoring of selenium and salt transport at numerous locations throughout Kesterson Reservoir; Quantitative analysis of the biogeochemical evolution of selenium in surfaces soils at Kesterson, including discussion of implications for biological exposure to selenium; Measurement and analysis of the first two comprehensive data sets on soil and groundwater quality on the former Frauds Ranch; Preliminary results from the pilot-scale selenium volatilization experiment in Pond 2; Evaluation of the rates of selenium transformation from one species to another based on laboratory experiments; Data on water quality in surface water pools that formed from ponded rainwater during the winters of 1990–1991 and 1991–1992; and Quality control and assurance statistics on our analytical laboratory.

33850 (LBL–34076) **Computeer-based decision support tools for evaluation of actions affecting flow and water quality in the San Joaquin Basin.** Quinn, N.W.T. Lawrence Berkeley Lab., CA (United States). Jan 1993. 136p. Sponsored by Department of the Interior, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93018597. Source: OSTI; NTIS; GPO Dep.

This document is a preliminary effort to draw together some of the important simulation models that are available to Reclamation or that have been developed by Reclamation since 1987. This document has also attempted to lay out a framework by which these models might be used both for the purposes for which they were originally intended and to support the analysis of other issues that relate to the hydrology and to salt and water quality management within the San Joaquin Valley. To be successful as components of a larger Decision Support System the models should to be linked together using custom designed interfaces that permit data sharing between models and that are easy to use. Several initiatives are currently underway within Reclamation to develop GIS - based and graphics - based decision support systems to improve the general level of understanding of the models currently in use, to standardize the methodology used in making planning and operations studies and to permit improved data analysis, interpretation and display. The decision support systems should allow greater participation in the planning process, allow the analysis of innovative actions that are currently difficult to study with present models and should lead to better integrated and more comprehensive plans and policy decisions in future years.

33851 (ORNL/TM–12235) **Pilot-scale field tests for the methanotrophic technology cometabolic bioreactor demonstration at the Oak Ridge K-25 Site.** Donaldson, T.L.; Lucero, A.J.; Jennings, H.L.; Herbes, S.E. Oak Ridge National Lab., TN (United States). Jun 1993. 59p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93017955. Source: OSTI; NTIS; GPO Dep.

This report describes a demonstration of cometabolic technology for bioremediation of groundwater contaminated with trichloroethylene (TCE) and other chlorinated and aromatic solvents conducted by Oak Ridge National Laboratory (ORNL). The technology demonstration is located at a seep from the K-1070-C/D Classified Burial Ground at the Oak Ridge K-25 Site. Funding for this demonstration is provided by the US Department of Energy (DOE), Environmental Restoration/Waste Management Program, Office of Technology Development.

33852 (PNL–8766) **Ecological evaluation of proposed dredged material from Wilmington Harbor and Military Ocean Terminal, Sunny Point, North Carolina.** Ward, J.A. (Battelle/Marine Sciences Lab., Sequim, WA (US)); Pinza, M.R.; Barrows, M.E.; Word, J.Q. Pacific Northwest Lab., Richland, WA (United States); Battelle/Marine Sciences Lab., Sequim, WA (United States). Jul 1993. 248p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019600. Source: OSTI; NTIS; GPO Dep.

This report is intended to provide information required to address potential ecological effects of the proposed disposal of Wilmington Harbor and Military Ocean Terminal, Sunny Point (MOTSU), North Carolina, sediments in the ocean. The report is divided into five sections. Section 1.0 is the introduction containing a brief overview

of the study and the study objectives. Section 2.0 describes the methods and materials used for sample collection, processing, toxicological and bioaccumulation testing, physical/chemical analysis of sediments and tissues, data analysis, and quality assurance procedures. Section 3.0 presents the results of field collections, sediment chemistry, toxicological testing, and tissue chemistry resulting from bioaccumulation exposures. Section 4.0 presents a discussion of the results and summary conclusions concerning the acceptability of the Wilmington Harbor and MOTSU dredged material for ocean disposal. Section 5.0 lists the literature cited in support of this document. A series of appendixes contain detailed data listings.

33853 (SSI–93-06) **Studies on the waste depository of the Sillamaee plant.** Ehdwall, H. (Swedish Radiation Protection Inst., Stockholm (Sweden)); Sundblad, B.; Nosov, V.; Putnik, H.; Mustonen, R.; Salonen, L.; Illus, E.; Qvale, H. Swedish Radiation Protection Inst., Stockholm (Sweden). 15 Mar 1993. 12p. Order Number DE94600125. Source: OSTI; NTIS; INIS.

The studies on the waste material in the Sillamaee depository indicate that the wall material of the depository is typical mill tailing from chemical enrichment of uranium ore. The results from the sea sampling show that the impact from the depository on the marine environment is obvious close to the shore-line. However, the concentrations of radioactive elements decrease very rapidly as the distance from the shore increases.

33854 (Y–2073/R1) **Rapid determination of uranium in natural waters by thermal emission mass spectrometry: Revision 1.** Ferguson, J.R.; Caylor, J.D.; Rogers, E.R.; Cole, S.H. Oak Ridge Y-12 Plant, TN (United States). 28 Mar 1977. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OS21400. (CONF-761043–1: 20. annual conference of analytical chemistry, Gatlinburg, TN (United States), 11-14 Oct 1976). Order Number DE93018592. Source: OSTI; NTIS; GPO Dep.

A six-inch radius mass spectrometer has been constructed and demonstrated to adequately analyze water samples for uranium concentrations down to 5 to 10 ng/liter (ppt). The precision and accuracy of the isotope-dilution, thermal emission method is sufficient to meet the needs of the Uranium Resources Evaluation (URE) project. A single analyst can analyze in excess of 50 samples per day, including all preparation and instrument time. This analysis rate will meet the economic constraints of the URE analytical program.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

Refer also to citation(s) 33016, 33454

5501 Behavioral Biology

Refer also to citation(s) 33808

33855 (EGG–10617-2159) **Effects of military-authorized activities on the San Joaquin kit fox (Vulpes velox macrotis) at Camp Roberts Army National Guard Training Site, California.** Berry, W.H.; Standley, W.G.; O'Farrell, T.P.; Kato, T.T. EG and G Energy Measurements, Inc., Goleta, CA (United States). Santa Barbara Operations. Oct 1992. 25p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract AC08-88NV10617. Order Number DE93018483. Source: OSTI; NTIS; INIS; GPO Dep.

The effects of military-authorized activities on San Joaquin kit fox (Vulpes velox macrotis) were investigated at Camp Roberts Army National Guard Training Site from 1988 to 1991. Military-authorized activities included military training exercises, facilities maintenance, new construction, controlled burning, livestock grazing, and public-access hunting. Positive effects of the military included habitat preservation, preactivity surveys, and natural resources management practices designed to conserve kit foxes and their habitat. Perceived negative effects such as entrapment in dens, shootings during military exercises, and accidental poisoning were not observed. Foxes were observed in areas being used simultaneously by military units. Authorized activities were known to have caused the deaths of three of 52 radiocollared foxes recovered dead: one became entangled in concertina wire, one was believed shot by a hunter, and one was struck by a vehicle. Entanglement in communication wire may have contributed to the death of another radiocollared fox that was killed by a predator. Approximately 10% of kit fox dens encountered showed evidence of vehicle traffic, but denning sites did not appear to be a limiting factor for kit foxes.

5502 Biochemistry

Refer also to citation(s) 32168, 32640, 32674, 33800, 33862, 33910, 33914, 33953

33856 (DOE/ER/20015–2) **Differential regulation of plastid mRNA stability: Progress report.** Stern, D.B. Boyce Thompson Inst. for Plant Research, Ithaca, NY (United States). Environmental Biology Dept. [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-90ER20015. Order Number DE93019889. Source: OSTI; NTIS; GPO Dep.

Our goal is to identify cis-acting sequences and transacting factors that function in plastid mRNA maturation, stabilization, and/or decay through an in vitro and in vivo analysis of mRNA:protein interactions. Our previous results emphasized the study of 3′end inverted repeat sequences (IRs) that serve both as mRNA processing elements and stability determinants, and associate with plastid proteins that potentially play enzymatic, structural and/or regulatory roles. We seek to define, by single base and internal deletion mutagenesis, the sequence and structural requirements for protein binding to the 3′ IRs of petD and psbA mRNAs; to purify RNA-binding proteins that demonstrate gene- or sequence-specific binding, or that are implicated in RNA stabilization or decay; and to investigate the native form of mRNA in the plastid, by attempting to purify ribonucleoprotein (RNP) particles from organelles. Our view of mRNA decay is that it is regulated by three interactive components: RNA structure, ribonucleases and RNA-binding proteins. We have used mutagenesis to study the role of RNA structure in regulating RNA decay rates, and to identify protein binding and endonuclease recognition sites. We have identified at least three endonuclease activities; one that cleaves psbA RNA; and two whose cleavage patterns with petD 3′ IR-RNA has been studied (endoC1 and endoC2). Additionally, we have continued to analyze the properties of the major RNA processing exoribonuclease. We have concentrated our efforts on three RNA-binding proteins. A 100 kd protein with properties suggestive of a mammalian RNP component has been purified. A protein of 55 kd that may also be an endonuclease has been partially purified. We have studied the interaction of a 29 kd protein with the petD stem/loop, and its role in RNA processing. Recently, we have used a novel gel shift/SDS-PAGE technique to identify new RNA-binding proteins.

33857 (DOE/ER/20055–4) **Transport function and reaction mechanism of vacuolar H^+- translocation inorganic pyrophosphatase: Annual technical progress report.** Pennsylvania Univ., Philadelphia, PA (United States). Dept. of Biology. [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER20055. Order Number DE93019884. Source: OSTI; NTIS; GPO Dep.

These studies describe progress made in the definition of the transport capabilities and reaction mechanism of the V-PPase through biochemical analyses of native membrane vesicles isolated from etiolated hypocotyls of Vigna radiate and by reconstitution of the purified enzyme into artificial liposomes; delineation of the ligand requirements of the V-PPase; and the delineation of sequence motifs implicated in substrate-binding through the development of strategies for selective cleavage of the M_r 66,000 polypeptide and the mapping of covalently modified peptide fragments.

33858 (DOE/ER/61235–T1) **[Nonhomologous mechanisms of repair of chromosomal breaks]: Progress report.** Haber, J.E. Brandeis Univ., Waltham, MA (United States). [1993]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER61235. Order Number DE93019986. Source: OSTI; NTIS; GPO Dep.

Broken chromosomes must either be repaired or lost. The break separates part of the chromosome, containing a telomere, from the

rest, containing a centromere. While the centromerecontaining fragment can properly segregate, the broken end will be progressively degraded. The acentric fragment cannot segregate and will also be degraded. We have centered our attention on two alternative nonhomologous mechanisms of repair: (1) the acquisition of a new telomere, and (2) repair of broken chromosomes by nonhomologous joining of broken chromosome ends. In both cases, we create a double-strand break at a defined chromosomal location in yeast cells. The break is created by the site-specific HO endonuclease in cells that carry the rad52 mutation to prevent repair of a double-strand break by homologous recombination. In diploid cells, we can recover cells that contain a terminally deleted, healed chromosome that has acquired a new telomere. In haploid cells, we can recover cells in which the double-strand break has been repaired by rejoining the broken ends, usually accompanied by a deletion.

33859 (SAND–93-8233) **A numerical study of hybrid optimization methods for the molecular conformation problems.** Meza, J.C.; Martinez, M.L. Sandia National Labs., Albuquerque, NM (United States). May 1993. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DR00789. Order Number DE93017898. Source: OSTI; NTIS; GPO Dep.

An important area of research in computational biochemistry is the design of molecules for specific applications. The design of these molecules depends on the accurate determination of their three-dimensional structure or conformation. Under the assumption that molecules will settle into a configuration for which their energy is at a minimum, this design problem can be formulated as a global optimization problem. The solution of the molecular conformation problem can then be obtained, at least in principle, through any number of optimization algorithms. Unfortunately, it can easily be shown that there exist a large number of local minima for most molecules which makes this an extremely difficult problem for any standard optimization method. In this study, we present results for various optimization algorithms applied to a molecular conformation problem. We include results for genetic algorithms, simulated annealing, direct search methods, and several gradient methods. The major result of this study is that none of these standard methods can be used in isolation to efficiently generate minimum energy configurations. We propose instead several hybrid methods that combine properties of several local optimization algorithms. These hybrid methods have yielded better results on representative test problems than single methods.

33860 (UCRL-ID–133636) **Sperm cells as vectors in the production of transgenic animals.** Prince, R.M. Lawrence Livermore National Lab., CA (United States). 28 Apr 1993. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93017963. Source: OSTI; NTIS; GPO Dep.

Transgenic animals are used in industry and in biomedical research in order to provide in vivo experimental model systems. Sperm cells have been reported used as vectors in the production of transgenic animals before, however no approach has of yet proven to be successful. Fertilizing eggs with genetically modified sperm would be advantageous in that sperm are readily accessible and stable, and eggs can be fertilized by modified sperm cells in vivo. Recent elucidations regarding the unique manner of DNA packaging in sperm chromatin by protamines has provided us with the insight for developing a method of introducing foreign DNA into sperm which is likely to succeed where others have failed. We have developed a method for mimicking the in vivo system of sperm chromatin toroid subunits in vitro, concentrating these toroids, and fluorescent visualization. Our present work concerns development of a method to successfully deliver DNA across the cell membranes and into the nucleus.

5503 Cytology

Refer also to citation(s) 33953

33861 (DOE/ER/20008–2) **Regulation of cell division in higher plants: Progress report, 1993.** Jacobs, T. Illinois Univ., Chicago, IL (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-90ER20008. Order Number DE93040691. Source: OSTI; NTIS; GPO Dep.

Recent work on the project has been focused almost exclusively on obtaining and characterizing CDNA clones encoding cylcin-dependent kinases (CDK), and cycling from pea. All of our work up to this time has relied on small PCR-generated CDNA clones of 2 putative pea CDKs and a putative pea mitotic cyclin, as well as anti-CDK antibodies of poor affinity and questionable specificity. Therefore, it has become a high priority for us to generate clones, probes and immunological tools in our own system. As of this writing, we have four putative CDKs (CdkPsl,2,3,& 4) and five putative cyclins (Cyc-Ps1,2,3,4,& 5), the DNA sequences of which have been determined to varying degrees of completeness.

5504 Genetics

Refer also to citation(s) 32168, 33858

33862 (CONF-8905192–4-App.A) **Genome sequencing by direct imaging x-ray color holography: Appendix A.** Haddad, W. (MCR Technology Corp., Chicago, IL (United States)); Boyer, K.; Solem, J.C.; Rhodes, C.K.; Moriarty, R.M. MCR Technology Corp., Chicago, IL (United States). [1989]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-89ER60898 ;FG02-86ER13610. From Conference on X-ray microimaging for the life sciences; Berkeley, CA (United States); 24-26 May 1989. Order Number DE93017913. Source: OSTI; NTIS; INIS; GPO Dep.

Currently available techniques for sequencing DNA are inadequate for oligonucleotides of length greater than 600 nucleotides and are most effective in the 300 nucleotide range. Automated sequencers are now available which use, basically, the Sanger dideoxy termination method. The sequencing rates of these conventional methods are extremely low and involve very labor intensive procedures, requiring on the order of two man-years of effort for the determination of the sequence of a single 100 kilobase segment. Since the full human genetic complement is of vast size, representing $\sim 3 \times 10^9$ bases, a fast and accurate method for DNA sequencing is needed. Therefore, we set as a goal a sequencing rate in the range of $\sim 10^2$ bp/s with an accuracy of ~ 1 error per 10^6 bases, a value exceeding that set by the fidelity of current enzymatic processes. These values would permit the accurate determination of the sequence of the full human genome in one year. An approach involving rapid direct imaging of large segments of DNA is desired. A properly constructed x-ray Fourier-transform holographic microscope appears to combine these features. A basic x-ray holographic instrument has been designed. This concept, with appropriate modifications, and the use of presently available x-ray sources, appears applicable to the task of genome sequencing with a resulting rate of sequence determination in the range of $\sim 10^2$ bp/s.

5505 Metabolism

Refer also to citation(s) 32677, 32678, 33924

5506 Medicine

Refer also to citation(s) 32621, 33476, 34413

33863 (DOE/EH–0331) **Office of Occupational Medicine: FY 1993, Annual report.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Aug 1993. 14p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93018387. Source: OSTI; NTIS; GPO Dep.

To date, we have assessed every DOE site at least once, many twice. With the information collected during these visits, EH-43 is developing a solid understanding of the occupational medical program activities at each site and will be better able to monitor progress. The assessment staff provided more specific technical assistance than in the past, especially in the area of compliance. In addition, the cardiovascular medical guidelines are near completion and the personnel assurance, firefighters, and protective force personnel medical guidelines are ready for the concurrence process.

33864 (DOE/ER/61226–2) **Diagnostic and therapeutic applications of diode lasers and solid state lasers in medicine: Progress report.** Jacques, S.L. (Texas Univ., Houston, TX (United States). Cancer Center); Welch, A.J.; Motamedi, M.; Rastegar, S.; Tittel, F.; Esterowitz, L. Texas Univ., Houston, TX (United States). Cancer Center. May 1993. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-91ER61226. Order Number DE93019597. Source: OSTI; NTIS; GPO Dep.

The Texas Medical Center in Houston and the nearby UT Medical Branch at Galveston together constitute a major center of medical research activities. Laser applications in medicine are under development with the engineering assistance of the collaborating engineering enters at Rice University, UT-Austin, Texas A&M Univ. In addition, this collective is collaborating with the naval Research Laboratory, where new developments in laser design are underway, in order to transfer promising new laser technology rapidly into the medical environment.

33865 (EGG-BNCT–10764-3/4) **INEL BNCT Research Program, March/April 1993.** Venhuizen, J.R. (ed.). EG and G Idaho, Inc., Idaho Falls, ID (United States). Jun 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93019028. Source: OSTI; NTIS; INIS; GPO Dep.

This report presents summaries for two months of current research of the Idaho National Engineering Laboratory Boron Neutron Capture Therapy Program. Information is presented on development and murine screening experiments of low-density lipoprotein, carboranyl alanine, and liposome boron containing compounds. Pituitary tumor cell culture studies are described. Drug stability, pharmacology and toxicity evaluation of borocaptate sodium and boronophenylalanine are described. Treatment protocol development via the large animal (canine) modal studies and physiological response evaluation in rats are discussed. Supporting technology development and technical support activities for boron drug biochemistry and purity, analytical and measurement dosimetry, and noninvasive boron quantification activities are included for the current time period. Current publications for the two months are listed.

33866 (LA-UR–93-2764) **Optical diagnostics based on elastic scattering: Recent clinical demonstrations with the Los Alamos Optical Biopsy System.** Bigio, I.J. (Los Alamos National Lab., NM (United States)); Loree, T.R.; Mourant, J.; Shimada, T.; Story-Held, K.; Glickman, R.D.; Conn, R. Los Alamos National Lab., NM (United States). [1993]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93018289. Source: OSTI; NTIS; GPO Dep.

A non-invasive diagnostic tool that could identify malignancy in situ and in real time would have a major impact on the detection and treatment of cancer. We have developed and are testing early prototypes of an optical biopsy system (OBS) for detection of cancer and other tissue pathologies. The OBS invokes a unique approach to optical diagnosis of tissue pathologies based on the elastic scattering properties, over a wide range of wavelengths, of the microscopic structure of the tissue. The use of elastic scattering as the key to optical tissue diagnostics in the OBS is based on the fact that many tissue pathologies, including a majority of cancer forms, manifest significant architectural changes at the cellular and sub-cellular level. Since the cellular components that cause elastic scattering have dimensions typically on the order of visible to near-IR wavelengths, the elastic (Mie) scattering properties will be strongly wavelength dependent. Thus, morphology and size changes can be expected to cause significant changes in an optical signature that is derived from the wavelength dependence of elastic scattering. The data acquisition and storage/display time with the OBS instrument is ~1 second. Thus, in addition to the reduced invasiveness of this technique compared with current state-of-the-art methods (surgical biopsy and pathology analysis), the OBS offers the possibility of impressively faster diagnostic assessment. The OBS employs a small fiber-optic probe that is amenable to use with any endoscope, catheter or hypodermic, or to direct surface examination (e.g. as in skin cancer or cervical cancer). It has been tested in vitro on animal and human tissue samples, and clinical testing in vivo is currently in progress.

33867 (ORNL/TM–12411) **Nuclear Medicine Program progress report for quarter ending June 30, 1993.** Knapp, F.F. Jr.; Ambrose, K.R.; Beets, A.L.; Callahan, A.P.; Hsieh, B.T.; McPherson, D.W.; Mirzadeh, S.; Lambert, C.R. Oak Ridge National Lab., TN (United States). Jul 1993. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93018493. Source: OSTI; NTIS; GPO Dep.

The "IQNP" agent is an antagonist for the cholinergic-muscarinic receptor. Since the IQNP molecule has two asymmetric centers and either cis or trans isomerism of the vinyl iodide, there are eight possible isomeric combinations. In this report, the systematic synthesis, purification and animal testing of several isomers of radioiodinated "IQNP" are reported. A dramatic and unexpected relation between the absolute configuration at the two asymmetric centers and the stereochemistry of the vinyl iodide on receptor specificity was observed. The E-(R)(R) isomer shows specific and significant localization (per cent dose/gram at 6 hours) in receptor-rich cerebral structures (i.e. Cortex = 1.38 + 0.31; Striatum = 1.22 + 0.20) and low uptake in tissues rich in the M_2 subtype (Heart = 0.10; Cerebellum = 0.04). In contrast, the E-(R)(S) isomer shows very low receptor-specific uptake (Cortex = 0.04; Striatum = 0.02), demonstrating the importance of absolute configuration at the acetate center. An unexpected and important observation is that the stereochemistry of the vinyl iodine appears to affect receptor subtype specificity, since the Z-(R,S)(R) isomer shows much higher uptake in the heart (0.56 + 0.12) and cerebellum (0.17 + 0.04). Studies are now in progress to confirm these exciting results in vitro. Progress has also continued during this period with several collaborative programs. The first large-scale clinical tungsten-188/rhenium-188 generator prototype (500 mCi) was fabricated and supplied to the Center for Molecular Medicine and Immunology (CMMI), in Newark, New Jersey, for Phase I clinical trials of rhenium-188-labeled anti CEA antibodies for patient treatment. Collaborative studies are also continuing in conjunction with the Nuclear Medicine Department at the University of Massachusetts where a generator is in use to compare the biological properties of "direct" and "indirect" labeled antibodies.

33868 (UCRL-CR–114236) **Malignant melanoma slide review project: Patients from non-Kaiser hospitals in the San Francisco Bay Area: Final report.** Reynolds, P. (California Dept. of Health Services, Berkeley, CA (United States)). Lawrence Livermore National Lab., CA (United States). 5 Jan 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (LLNL–1A1503). Order Number DE93019116. Source: OSTI; NTIS; GPO Dep.

This project was initiated, in response to concerns that the observed excess of malignant melanoma among employees of Lawrence Livermore National Laboratory (LLNL) might reflect the incidence of disease diagnostically different than that observed in the general population. LLNL sponsored a slide review project, inviting leading dermatopathology experts to independently evaluate pathology slides from LLNL employees diagnosed with melanoma and those from a matched sample of Bay Area melanoma patients who did not work at the LLNL. The study objectives were to: Identify all 1969–1984 newly diagnosed cases of malignant melanoma among LLNL employees resident in the San Francisco-Oakland Metropolitan Statistical Area, and diagnosed at facilities other than Kaiser Permanente; identify a comparison series of melanoma cases also diagnosed between 1969–1984 in non-Kaiser facilities, and matched as closely as possible to the LLNL case series by gender, race, age at diagnosis, year of diagnosis, and hospital of diagnosis; obtain pathology slides for the identified (LLNL) case and (non-LLNL) comparison patients for review by the LLNL-invited panel of dermatopathology experts; and to compare the pathologic characteristics of the case and comparison melanoma patients, as recorded by the dermatopathology panel.

33869 (UCRL-ID–113760) **Signal processing of Shiley heart valve data for fracture detection.** Mullenhoff, C. Lawrence Livermore National Lab., CA (United States). 1 Apr 1993. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93018908. Source: OSTI; NTIS; GPO Dep.

Given digital acoustic data emanating from the heart sounds of the beating heart measured from laboratory sheep with implanted Bjoerk-Shiley Convexo-Concave heart valves, it is possible to detect and extract the opening and closing heart beats from the data. Once extracted, spectral or other information can then obtained from the heartbeats and passed on to feature extraction algorithms, neutral networks, or pattern recognizers so that the valve condition, either fractured or intact, may be determined.

33870 (UCRL-ID–114802) **Detection of "single-leg separated" heart valves using statistical pattern recognition with the nearest neighbor classifier.** Buhl, M.R.; Clark, G.A.; Candy, J.V.; Thomas, G.H. Lawrence Livermore National Lab., CA (United States). 16 Jul 1993. 45p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93018911. Source: OSTI; NTIS; GPO Dep.

The goal of this work was to detect "single-leg separated" Bjoerk-Shiley Convexo-Concave heart valves which had been implanted in sheep. A "single-leg separated" heart valve contains a fracture in the outlet strut resulting in an increased risk of mechanical failure. The approach presented in this report detects such fractures by applying statistical pattern recognition with the nearest neighbor classifier to the acoustic signatures of the valve opening. This approach is discussed and results of applying it to real data are given.

5507 Microbiology

Refer also to citation(s) 32174, 32203, 32256, 32677, 32678, 32731, 33826, 33851

5509 Pathology

Refer also to citation(s) 33868

5510 Physiological Systems

Refer also to citation(s) 33861

5520 Public Health

Refer also to citation(s) 33793, 33863

5530 Agriculture and Food Technology

Refer also to citation(s) 32619, 32640, 33800, 33860, 33947

33871 (AECS-A/FRSR–69) **Feasibility for the disinfestation of pulses and cereal grains by irradiation.** Mansour, M.Y. (Atomic Energy Commission, Damascus (Syrian Arab Republic). Dept. of Radiation Agriculture); Al-Bachir, M. Atomic Energy Commission, Damascus (Syrian Arab Republic). May 1993. 16p. (CONF-9303213–: 3. research coordination meeting on food irradiation program for the Middle East and European countries, Cadarache (France), 8 Mar 1993). Order Number DE94600170. Source: OSTI; NTIS (US Sales Only); INIS.

The faba bean seed beetle,Bruchus Dentipes Baudi, the lentil seed beetle, B.ervi Froel, and the European lentil seed beetle, B.lentis Froel are the most important insect pests of lentil and faba bean in Syria. Adults lay their eggs on the green pods in the field and immature stages develop inside the seeds. Infestation rate differs from year to year and from one location to another. In 1991, it ranged between 9.6 and 13.90 for lentil seeds and 31.00 to 57.39% for faba bean seeds depending on the region. This reduced the economic value by about 50% for faba bean seeds and 20 - 30% for lentil seeds. Current disinfestation methods are unsafe and not adequately effective. Ionizing radiation could be an alternative approach. An investigation was initiated to determine the possibility of applying the irradiation disinfestation technique against these pests. The dose of gamma radiation needed for disinfecting faba bean seeds infested with B.Dentipes was found to be 90 Gy for the last two larval instars. Immature stages of B.ervi and B.lentis develop very rapidly in the field and reach the pupal or adult stage by harvest. This makes the application of this technique for disinfecting lentil seeds of little or no value. However, the results indicate that the irradiation disinfestation method could be an advantageous approach for disinfecting faba bean seeds. (author). 38 refs., 4 tabs., 1 fig.

33872 (IAEA-TECDOC–708) **Improving the productivity of indigenous African livestock: Results of FAO/IAEA/DGIS co-ordinated research programmes.** Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Jun 1993. 172p. Order Number DE94600178. Source: OSTI; NTIS (US Sales Only); INIS.

This document summarizes the results of two Co-ordinated Research Programs to improve the productivity of indigenous African livestock. After an introduction and a summary the reports of the participating countries are presented. The individual contributions have been indexed separately. Refs, figs and tabs.

33873 (IAEA-TECDOC–708, pp. 7-11) **Introduction.** Plaizier, J.C.B. (Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Animal Production and Health Section). Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Jun 1993. In *Improving the productivity of indigenous African livestock: Results of FAO/IAEA/DGIS co-ordinated research programmes.* 172p. Order Number DE94600178. Source: OSTI; NTIS (US Sales Only); INIS.

This article briefly introduces the problems relating to agricultural production in Africa, with special emphasis on the contribution of ruminant livestock. Possible strategies for future research are also outlined. 11 refs.

33874 (IAEA-TECDOC–708, pp. 13-28) **Co-ordinated research programmes on improving the productivity of indigenous African livestock.** Plaizier, J.C.B. (Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Animal Production and Health Section). Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Jun 1993. In *Improving the productivity of indigenous African livestock: Results of FAO/IAEA/DGIS co-ordinated research programmes.* 172p. Order Number DE94600178. Source: OSTI; NTIS (US Sales Only); INIS.

A three-year Co-ordinated Research Program on "Immunoassay techniques to improve the reproductive efficiency and health status of indigenous African livestock" was funded from November 1986, and in March 1990 the Program was extended for a further three years with the title "Improving the productivity of indigenous African livestock through integrated studies on smallholder farms, and the use of improved methods for diagnosing and controlling trypanosomiasis". This article summarizes the work performed under the two Programs. 6 refs, 1 fig., 2 tabs.

33875 (IAEA-TECDOC–708, pp. 31-38) **Factors affecting the reproductive performance of Bunaji cattle under different pastoral management systems in the Guinea savanna zone of Nigeria.** Eduvie, L.O. (Ahmadu Bello Univ., Zaria (Nigeria). National Animal Production Research Inst.); Bawa, E.K.; Dawuda, P.M.; Oyedipe, E.O.; Olorunju, S.A.S.; Bales, J.O.; Sekoni, V.O. Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Jun 1993. In *Improving the productivity of indigenous African livestock: Results of FAO/IAEA/DGIS co-ordinated research programmes.* 172p. Order Number DE94600178. Source: OSTI; NTIS (US Sales Only); INIS.

The effects of management on the productivity of Bunaji cattle were investigated on 6 farms using 38 post-partum cows and 8 heifers. General information obtained on management of the farms indicated differences in managements practices between farms. The screening of the animals in the various farms for blood and endo-parasites showed that some of the farms had problems of helminthiasis and fascioliasis. Uterine involution was complete within 25 days of calving in all post-partum cows. Intervals from calving to ovulation and conception were different between farms. The conception rates for all farms over a period of 730 days ranged from 60 to 100%. A higher percentage of heifers on farm A reached puberty at an earlier age than those in farm B. It was concluded that management affects reproductive performance and

thus productivity of Bunaji cattle, with nutrition and disease being the major contributing factors. (author). 10 refs, 7 tabs.

33876 (IAEA-TECDOC–708, pp. 39-47) **Growth and first ovulations of Santa-Gertrudis heifers in Morocco.** Haddada, B. (Institut Agronomique et Veterinaire Hassan II, Rabat (Morocco). Dept. de Reproduction Animale); Lahlou Kassi, A.; Tibary, A.; Thibier, M. Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Jun 1993. (In French). In *Improving the productivity of indigenous African livestock: Results of FAO/IAEA/DGIS co-ordinated research programmes.* 172p. Order Number DE94600178. Source: OSTI; NTIS (US Sales Only); INIS.

The objective of this study was to study the variations in body weight and rate of cyclicity during the 7 months prior to the mating season (September - January), and to study the effects of these variations on the fertility of Santa-Gertrudis heifers kept under a "Ranching" management system. A total of 91 heifers divided into 2 groups, 47 females born in December - January (early) and 44 born in March (late), were included in the study. The animals were weighed and blood sampled for the assay of progesterone weekly. Two months after the end of the mating season pregnancy was diagnosed by rectal palpation. The study demonstrated a highly significant ($P < 0.001$) influence of season of birth on body weight. In the early heifers a significant loss ($P < 0.001$) in body weight and a decrease in rate of cyclicity were observed between July and November. The average body weight decreased from 298 $\pm$ 3.1 kg(X-bar $\pm$ s.e.m.) to 272 $\pm$ 2.8 kg and the percentage of animals cycling decreased from 75% to 57% in this period. Between November and January, the early heifers showed a significantly ($P < 0.001$) higher increase in body weight than the late heifers. In January the average body weight and rate of cyclicity of all heifers was 288 $\pm$ 3.8 kg and 65% respectively. The animals cycling at the beginning of the mating season (15 January) showed a higher body weight gain ($P < 0.05$) than the non-cycling ones. Fifty five percent of the heifers were found pregnant by rectal palpation. In addition, the pregnant animals showed a significantly ($P < 0.05$) higher body weight gain than the non-pregnant animals during the period November-February. These results indicate that variations in body weight and rate of cyclicity do not allow an optimal conception rate of 80%. (author). 16 refs, 4 figs, 4 tabs.

33877 (IAEA-TECDOC–708, pp. 49-57) **Reproductive performance of Tanzanian Mpwapwa cattle at puberty and post-partum.** Kanuya, N.L. (Sokoine Univ. of Agriculture, Morogoro (Tanzania). Dept. of Veterinary Surgery, Obstetrics and Reproduction); Nkya, R.; Kessy, B.M. Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Jun 1993. Contract IAEA-R-4976/NL. In *Improving the productivity of indigenous African livestock: Results of FAO/IAEA/DGIS co-ordinated research programmes.* 172p. Order Number DE94600178. Source: OSTI; NTIS (US Sales Only); INIS.

Twenty on Mpwapwa heifers between 1 and 1.5 years of age were included in an experiment to determine age and weight at puberty. Background information about the animals was obtained from farm records. The animals were weighed at specific intervals. Weekly blood samples for progesterone concentration determination were obtained by jugular venipuncture. Twenty two cows of the same breed were included in another experiment to determine the length of post-partum acyclic period. Cows in oestrus were naturally bred. Starting from the first week of calving, blood samples for progesterone determination were obtained on a weekly basis until the cows were diagnosed pregnant. Seventeen heifers attained puberty at an average age of 916 $\pm$ 106 (mean $\pm$ sd) days. The range was between 742 and 1123 days. Heifers born in the dry season reached puberty at a later age ($P < 0.01$) than those born in the wet season but all attained similar bodyweight (215 $\pm$ 17) kg when ovarian cycles commenced. The mean interval between calving and initiation of ovarian activity was 104 $\pm$ 50 days. Fifteen out of 19 cows conceived again during the period under study, the mean interval between calving and conception was 158 $\pm$ 86 days. It can be concluded that Mpwapwa heifers reach puberty at an advanced age and cows of the same breed have a long post-partum acyclic period. Strategies such as dry season supplementary feeding should be implemented to improve reproductive performance. (author). 32 refs, 1 fig., 3 tabs.

33878 (IAEA-TECDOC–708, pp. 59-66) **Studies on the influence of nutrition before and after lambing on the response of barbary ewes to the "ram effect" in Tunisia.** Lassoued, N. (INRAT, Ariana (Tunisia). Lab. des Recherches Ovine et Caprines); Khaldi, G. Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Jun 1993. (In French). In *Improving the productivity of indigenous African livestock: Results of FAO/IAEA/DGIS co-ordinated research programmes.* 172p. Order Number DE94600178. Source: OSTI; NTIS (US Sales Only); INIS.

The aim of this work was to study the effect of the nutritional level during the last 12 weeks of pregnancy and the first 18 weeks of lactation on the response of Barbary ewes of the "ram effect", in spring. The experiment was conducted on 140 adult females divided, according their nutritional level during pregnancy, into 2 groups H (High) and L (Low) and into 4 groups HH (High pregnancy, High Lactation), HL (High pregnancy, Low Lactation), LH (Low pregnancy, High Lactation) and LL (Low pregnancy, Low Lactation), during lactation. The ewes were mated by rams of the same breed. The ovarian activity of ewes was controlled by coelioscopy at Day-1 Day+4, Day+9, and some days after the first oestrus. The results of this study showed that the response of ewes to the "ram effect" was not related to their nutritional level during pregnancy and lactation, provided they were well fed between weaning of lambs and mating. In fact, the introduction of rams into the flock induced ovulation in all of the ewes. However, undernutrition during pregnancy and/or lactation decreased the percentage of cycling females before teasing (HL:31%, LH:35%, LL:33%) in comparison with the well fed ewes (HH:66%) and increased the proportion of the short induced ovarian cycles (HL:67%, LH:75%, LL:79%, against only 45% in the HH group). The effect of flushing on the ovulation rate was shown in the LL group which had the highest ovulation rate (1.79) in comparison with the other groups. On the other hand, teasing had a similar effect to flushing since the induced ovulation rate was higher than that of the following ovulations. (author). 18 refs, 2 figs, 5 tabs.

33879 (IAEA-TECDOC–708, pp. 67-72) **Effect of progesterone on the ram-induced corpus luteum life span in the barbary ewe in Tunisia.** Lassoued, N. (INRAT, Ariana (Tunisia). Lab. des Recherches Ovines et Caprines); Khaldi, G. Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Jun 1993. (In French). In *Improving the productivity of indigenous African livestock: Results of FAO/IAEA/DGIS co-ordinated research programmes.* 172p. Order Number DE94600178. Source: OSTI; NTIS (US Sales Only); INIS.

Ovulation is induced in seasonal anestrous Barbary ewes by using the "ram effect". Heats induced by this technique are distributed over 10 days (between day 13 and 23). The existence of short ovarian cycles following the induced ovulation is responsible for this dispersion of oestrus. The aim of this work is to improve the natural technique of the "male effect" by associating it to a progestative treatment leading to a better synchronization of heats. Thirty adult Barbary ewes were distributed into 2 groups: 1) a control group ("ram effect"); and 2) a treated group ("ram effect + 20 mg of progesterone). This injection of progesterone did not affect the response to the "male effect" since all treated ewes ovulated during the first 4 days after the introduction of rams. Moreover, this treatment prevented the occurrence of the short ovarian cycles. The preovulatory LH surge occurred 20.5 $\pm$ 10.78 and 58.9 $\pm$ 10.10 hours after the introduction of males in the control and treated groups respectively. Thus progesterone delayed the preovulatory surge of LH. This result suggests that this hormone induces normality of corpora lutes by lengthening the period of gonadotrophin priming of follicules before ovulation, or progesterone may affect the preovulatory follicles directly. Moreover, the effect of treatment on the distribution of oestrus was effective. The heats were synchronized during 3 days (between days 17 and 20 after the introduction of males). Even though this distribution was dispersed in the control group (between days 14 and 23). (author). 17 refs, 2 figs, 1 tabs.

33880 (IAEA-TECDOC–708, pp. 73-80) **Reproductive performance of Zambian goats under drought conditions.** Lovelace, C.E.A. (Zambia Univ., Lusaka (Zambia). Samora Machel School of Veterinary Medicine); Masebe, P.O.C.S.; Sakala, B.; Nyirenda, I.;

Sikazwe, G.; Mizinga, K.M.; Lungu, J.C.N. Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Jun 1993. In *Improving the productivity of indigenous African livestock: Results of FAO/IAEA/DGIS co-ordinated research programmes.* 172p. Order Number DE94600178. Source: OSTI; NTIS (US Sales Only); INIS.

Goats play a very important role in integrated farming in Zambia. Two surveys of husbandry practices in Gwembe Valley and Siavonga District, Southern Province, were carried out. Herd sizes varied from 3 to 300 goats with a buck:doe ratio of 1:18. In two separate experiments, serum progesterone levels were measured in goats on-station to determine the duration of the oestrus cycle. This duration varied between 10 and 26 days. The average duration of the oestrus cycle was 17.6 and 19.8 days in the first and second experiment respectively. A survey including over 60 goats belonging to 10 farmers in Lusitu, Siavonga District, is being undertaken. The region has suffered a severe drought, but the goats has showed no loss in weight and have maintained total serum protein and blood cell levels. (author). 14 refs, 1 fig., 3 tabs.

33881 (IAEA-TECDOC–708, pp. 73-80) **Studies on cyclic ovarian activity in pre-puberal heifers and post-partum cows of the Gobra Zebu breed in Senegal.** Mbaye, M. (Laboratoire National d'Elevage et de Recherches Veterinaires, Dakar-Hann (Senegal)); Ndiaye, M. Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Jun 1993. (In French). In *Improving the productivity of indigenous African livestock: Results of FAO/IAEA/DGIS co-ordinated research programmes.* 172p. Order Number DE94600178. Source: OSTI; NTIS (US Sales Only); INIS.

The objective of this study was to determine the age at the onset of puberty in heifers, and the resumption of ovarian activity post-partum in cows of the Gobra Zebu breed. The study was conducted at the Centre de Recherches Zootechniques (CRZ) in Dahra. The CRZ is located in the sylvo-pastoral zone of Senegal. The female offspring were kept with their mothers until weaning at an age of 7 months. After this age they were grazed on natural pasture with ad-lithium watering. The heifers and cows were monitored for 14 and 4 months respectively. This monitoring included the detection oestrous behaviour, weighing, and RIA of progesterone in blood plasma. The heifers showed an average daily weight gain of 418 and 235 g/d prior to and after weaning respectively. An an age of 14 months, 17 of the 21 heifers had shown signs of oestrus behaviour at least once. The average age at first plasma progesterone rise was 413 $\pm$ 64 days(X-bar $\pm$ sem) with and average body weight of 176 $\pm$ 22.2 kg. This age is correlated with the body weight at weaning. In cows the resumption of ovarian activity post-partum proceeded progressively. Based on heat observations, 4 and 6 out of 13 cows resumed ovarian activity 50 and 60 days post-partum respectively. Based on plasma progesterone levels, resumption of ovarian activity occurred between 36 and 48 days post-partum in 7 out of the 13 animals. Other data collected showed that Gobar Zebu cattle have a late age at first calving (51 months) and long calving intervals (430 to 530 days). This study shows that the Zebu Gobra can commence cyclic ovarian activity at an early age, and that the duration of post-partum acyclicity can be short. This allows the development of strategies to improve the productivity of Zebu Gobra cattle. (author). 41 refs, 3 figs, 1 tab.

33882 (IAEA-TECDOC–708, pp. 91-102) **Improving the productivity of indigenous goats in Zimbabwe.** Ndlovu, L.R. (Zimbabwe Univ., Harare (Zimbabwe). Dept. of Animal Science); Sibanda, L.M. Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Jun 1993. In *Improving the productivity of indigenous African livestock: Results of FAO/IAEA/DGIS co-ordinated research programmes.* 172p. Order Number DE94600178. Source: OSTI; NTIS (US Sales Only); INIS.

The productivity of indigenous goats was monitored in two areas which are situated in semi-arid regions of Zimbabwe. Both had low and erratic rainfall (400-600 mm per year) and three seasons were identified: hot wet (November to March), cool dry (April to July) and hot dry (August to October). Goats had long kidding intervals (370 d and 311 d, respectively), had slow growth rates (45 and 50 g/d) and high mortalities (41% and 36% by weaning age) in both areas. Seasonal effects were prominent for all production parameters but there was no season that consistently improved the productivity of goats. In one of the areas which had the highest incidence of births during the dry season, feed availability was the major constraint. An on-station feeding trial with pregnant does was carried out to investigate the effect of improved doe nutrition on kid performance. Does were offered three levels of feeding, High, Medium and Low pre-partum and does on each level were further allocated to either high or low feeding level post-partum. Pre-partum feeding levels did not affect kid birth weight (mean 3.0 kg), but improved doe live-weight at parturition. Post-partum feeding increased kid growth rate up to 42 d post-partum but had no effect on subsequent growth up to 105 d which was approximately 90 g/d. This growth rate was double that observed in communal area flocks. Strategic supplementation would improve productivity of indigenous goats in smallholder farming systems in Zimbabwe. (author). 13 refs, 4 figs, 8 tabs.

33883 (IAEA-TECDOC–708, pp. 103-112) **Studies on the reproductive performance of indigenous beef cattle breeds raised on-farm in Ghana.** Osei, S.A. (University of Science and Technology, Kumasi (Ghana). Dept. of Animal Science); Karikari, P.K.; Tuah, A.K.; Gyawu, P.; Opoku, R.S.; Asiama, M.; Heathcote, D.C. Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Jun 1993. Contract IAEA-R-4825/NL. In *Improving the productivity of indigenous African livestock: Results of FAO/IAEA/DGIS co-ordinated research programmes.* 172p. Order Number DE94600178. Source: OSTI; NTIS (US Sales Only); INIS.

Studies were undertaken to investigate the reproductive performance of a mixture of N'dama and West African Shorthorn (N'dama/WASH) and Sanga cattle raised under traditional management conditions on four privately owned small-holder farms. The first study involved an analysis of reproductive records and the measurement of plasma progesterone concentration to delineate the onset of various reproductive phenomena, including age at puberty and first calving, post-partum resumption of ovarian activity and other abnormal events like abortions. The second study investigated the influence of dry-season feed supplementation on reproductive performance. In study 1 the ages at first plasma progesterone rise (puberty), first mating and first calving for N'dama/WASH cattle on three farms averaged 981, 1016 and 1296 days respectively. The calving interval, calving-to-progesterone rise and calving-to-mating averaged 412, 129 and 114 days respectively. Significant differences existed among farms with Farms 1 and 2 out-performing Farm 3. The respective mean ages at first progesterone elevation, first mating and first calving for Sanga cattle (Farm 4) were 964, 990 and 1271 days while calving-to-progesterone rise, calving-to-mating and calving intervals averaged 107, 150 and 431 days. In study 2, dry-season feed supplementation generally reduced ages at puberty and first calving as well as the interval of post-partum acyclicity. (author). 18 refs, 3 figs, 9 tabs.

33884 (IAEA-TECDOC–708, pp. 121-126) **Breeding soundness and its relevance to the AI-bulls.** Thibier, M. (UNCEIA, Maisons-Alfort (France). Lab. de Controle des Reproducteurs). Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Jun 1993. (In French). In *Improving the productivity of indigenous African livestock: Results of FAO/IAEA/DGIS co-ordinated research programmes.* 172p. Order Number DE94600178. Source: OSTI; NTIS (US Sales Only); INIS.

The present review indicates some of the conditions following which an accurate evaluation of the breeding soundness of young post-pubertal bulls can be made. This relies on the following components: sexual behaviour, testis morphology, sperm production, hormonal profiles, semen output. A combination of these traits results in discarding up to 20 - 25% of the bulls prior to their entry into AI centers. This finally results in contributing to improve the mean potential of fertility in a given population hence giving an additional advantage to this remarkable technique, namely Artificial Insemination. (author). 9 refs, 3 figs, 2 tabs.

33885 (IAEA-TECDOC–708, pp. 127-131) **Pathophysiology, diagnosis and therapy of ovarian disorders post-partum in dairy cattle.** Willemse, A.H. (Utrecht Univ., Utrecht (Netherlands). Dept. of Herd Health and Reproduction). Joint FAO/IAEA Div. of

Nuclear Techniques in Food and Agriculture, Vienna (Austria). Jun 1993. In *Improving the productivity of indigenous African livestock: Results of FAO/IAEA/DGIS co-ordinated research programmes.* 172p. Order Number DE94600178. Source: OSTI; NTIS (US Sales Only); INIS.

The neuroendocrine events leading to the development of a dominant follicle and ovulation are described, and pathogenesis, clinical symptoms, diagnosis and therapy of cystic ovarian disease discussed. In addition, descriptions of follicular growth and endocrine changes in post-partum cows, reasons for prolonged post-partum acyclicity, and hormonal methods to induce first oestrus and ovulation are given. (author). 8 refs.

33886 (IAEA-TECDOC–708, pp. 133-142) **Productivity and ovarian activity of Peul sheep under indigenous management in Niger.** Yenikoye, A. (Niamey, Univ., Niamey (Niger). Faculte d'Agronomie); Marichatou, H. Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Jun 1993. (In French). Contract IAEA-R-4864/NL. In *Improving the productivity of indigenous African livestock: Results of FAO/IAEA/DGIS co-ordinated research programmes.* 172p. Order Number DE94600178. Source: OSTI; NTIS (US Sales Only); INIS.

Parameters of reproduction and various ovarian activities were studied in Peul ewes bred in traditional management. The litter size was 1,1 ± 0,05 (X-bar ± s.e.m.); it was not affected by season and rank of birth. The intervals between successive parturitions lasted for 325 ± 12 days. This interval was affected by the wet season, but it was not affected by the rank of parturition. There were births all through the year. The maximum frequency of birth was found during the second part of wet season and during post rain period. The minimum frequency of birth was found during the dry season and during the first part of the wet season. The rate of reproduction was 1,25 lambs per ewe per year. The normal ovarian activity was characterized by the luteal phase, which lasted for 13 ± 0,2 days with a highest level of progesterone of 2,5 ± 0,2 ng/ml. The normal follicular phase lasted for 4 ± 0,2 days with progesterone levels varying between 0 and 0,2 ng/ml. During the year, normal ovarian activity was interrupted by short luteal phases (duration = 9 ± 0 days; frequency 10%) during the dry/cold season, and by prolonged follicular phases (duration = 20 ± 4,1 days; frequency = 39%) all through the year. The incidence of these anomalies after kidding was estimated at 25%. The resumption of the ovarian activity occurred between 32 and 191 days after parturition. This parameter was not affected by the season; but it was correlated negatively with the weight of animals during the first month after parturition ($r = -0,77$; $P < 0,05$). These results suggest that the Peul sheep kept on a poor diet preserve good reproductive potentials. The results also suggest that the improvement of diet during post-partum would allow the Peul sheep to increased their reproductive capacities. (author). 16 refs, 3 figs, 2 tabs.

33887 (IAEA-TECDOC–708, pp. 143-147) **Study on the growth rate and puberty in heifers of trypanotolerant N'dama and Baoule breeds in Cote d'Ivoire.** Yesso, P. (IDESSA, Bouake (Cote d'Ivoire). Dept. Elevage); Meyer, C. Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Jun 1993. (In French). In *Improving the productivity of indigenous African livestock: Results of FAO/IAEA/DGIS co-ordinated research programmes.* 172p. Order Number DE94600178. Source: OSTI; NTIS (US Sales Only); INIS.

Growth rates and ovarian activity were monitored in heifers of trypanotolerant N'dama and Baoule breeds (10 N'dama and 20 Baoule) between the ages of 12 and 18 months. The onset of puberty was determined by RIA of progesterone in blood plasma. Only 18 animals (5 N'dama and 13 Baoule) attained puberty during the study. Body weight at onset of puberty was around half of the adult body weight. Relationships between level of nutrition and onset of puberty, daily growth rate and ovarian cyclicity could not be demonstrated. (author). 18 refs, 1 fig., 2 tabs.

33888 (IAEA-TECDOC–708, pp. 151-156) **Validation of the FAO/IAEA RIA kit for the measurement of progesterone in skim milk and blood plasma.** Plaizier, J.C.B. (Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria)). Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Jun 1993. In *Improving the productivity of indigenous African livestock: Results of FAO/IAEA/DGIS co-ordinated research programmes.* 172p. Order Number DE94600178. Source: OSTI; NTIS (US Sales Only); INIS.

Validation data for the FAO/IAEA RIA kit for the measurement of progesterone in blood plasma and skim milk obtained by Diagnostic Products Corporation, Los Angeles, USA, and the FAO/IAEA Agricultural Laboratory at Seibersdorf are given. The assay sensitivity as determined by FAO/IAEA was 0.3 nmol/l. Intra-assay and inter-assay variations were lower than 10% and 15% respectively. The accuracy of the assay was satisfactory. The percentage cross-reactivity for the potentially cross-reacting steroids were all acceptably low (i.e. below 2.4%). The assay characteristics for the RIA kit were therefore satisfactory. (author). 2 refs, 7 tabs.

33889 (IAEA-TECDOC–708, pp. 157-170) **Field validation of an EIA kit for progesterone measurement in milk and blood plasma.** Plaizier, J.C.B. (Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria)). Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Jun 1993. In *Improving the productivity of indigenous African livestock: Results of FAO/IAEA/DGIS co-ordinated research programmes.* 172p. Order Number DE94600178. Source: OSTI; NTIS (US Sales Only); INIS.

An EIA kit for the measurement of progesterone in blood plasma and skim milk was validated and compared with the FAO/IAEA RIA kit at the FAO/IAEA Agricultural Laboratory at Seibersdorf and 9 other laboratories in developed and developing countries. The EIA kit performed well at the FAO/IAEA Laboratory. In the other laboratories high intra-assay variations and poor colour development were observed. The RIA kit performed satisfactory in all participating laboratories. It was concluded that the EIA kit should not be routinely supplied to FAO/IAEA counterpart staff. Some recommendations for further development of the EIA kit were given. (author). 3 refs, 5 tabs.

33890 (IAEA/UNDP–INS/88/013-11) **Agricultural production - Phase 2. Indonesia. Isolation of arboviruses, their identification and the identification of their culicoides vectors in Indonesia: Technical report. Report prepared for the Government of the Republic of Indonesia.** Mellor, P.S. International Atomic Energy Agency, Vienna (Austria); United Nations Development Programme. 1991. 17p. Project INS/88/013;INS/5/021. Order Number DE94600160. Source: OSTI; NTIS (US Sales Only); INIS.

The aims of the two-week mission were to provide assistance in studies to determine the incidence and importance of arbovirus infection in ruminants in Indonesia, specifically to help with identification of the vectors tat transmit bluetongue and related arbovirus infections, and to develop work plans for future studies under the project. The report contains detailed information on handling systems for Culicoides species, on identification of Culicoides to be used for viral isolation and on the isolation of virus from Culicoides.

33891 (IAEA/UNDP–INS/88/013-13) **Agricultural production - Phase 2. Indonesia. Application of molasses-urea blocks to ruminant production in Indonesia: Technical report. Report prepared for the Government of the Republic of Indonesia.** Leng, R.A. (New England Univ., Armidale, NSW (Australia). Dept. of Biochemistry and Nutrition). International Atomic Energy Agency, Vienna (Austria); United Nations Development Programme. 1991. 10p. Project INS/88/013;INS/5/021. Order Number DE94600179. Source: OSTI; NTIS (US Sales Only); INIS.

This report summarizes briefly the accomplishments of a Coordinated Research Program to increase ruminant productivity in Indonesia by the application of urea-molasses blocks. The technology is highly cost effective and readily accepted by farmers. Suggestions are made for a three-year follow-up project to investigate the productivity of ruminants fed with packaged rice straw. 6 photographs.

33892 (IAEA/UNDP–INS/88/013-14) **Agricultural production - Phase 2. Indonesia. Rice - azolla - fish culture - use of nuclear technique: Technical report. Report prepared for the Government of the Republic of Indonesia.** Watanabe, Iwao. International

Atomic Energy Agency, Vienna (Austria); United Nations Development Programme. 1991. 12p. Project INS/88/013;INS/5/021. Order Number DE94600150. Source: OSTI; NTIS (US Sales Only); INIS.

The primary aim of the expert mission was to provide advice on the use of nuclear techniques to study rice-azolla-fish culture. Results of the work performed so far show that basal application of azolla gives similar or better yields of rice than basal application of urea. Fish productivity was also found to be significantly higher when azolla is present. 2 tabs.

33893 (IAEA/UNDP–INS/88/013-15) **Agricultural production - Phase 2. Indonesia. Methods for increasing ruminant production from available feed resources in Indonesia - nutrition-reproduction interactions: Technical report. Report prepared for the Government of the Republic of Indonesia.** Entwistle, K.W. (James Cook Univ. of North Queensland, Townsville (Australia). Graduate School of Tropical Veterinary Science and Agriculture). International Atomic Energy Agency, Vienna (Austria); United Nations Development Programme. 1991. 10p. Project INS/88/013;INS/5/021. Order Number DE94600180. Source: OSTI; NTIS (US Sales Only); INIS.

This report contains summarized data on the effects of urea-molasses block (UMB) food supplements in dairy and beef cattle, sheep and goats in Java. In addition to improvements in growth and milk production, UMB supplements cause a significant enhancement of ovulation rate and hence fecundity in sheep and goats. Similar data for dairy cattle are not yet available. 5 tabs.

33894 (IAEA/UNDP–THA/85/004-17) **Improving food and agricultural production. Thailand. Biological nitrogen fixation: Technical report. Report prepared for the Government of the Republic of Thailand.** Bowen, G.D. International Atomic Energy Agency, Vienna (Austria); United Nations Development Programme. 1991. 8p. Project THA/85/004;THA/5/031. Order Number DE94600151. Source: OSTI; NTIS (US Sales Only); INIS.

The aim of the mission was to assist the counterpart scientists in the analysis and interpretation of data relating to nitrogen fixation studies on grain legumes. The report briefly summarizes the discussions that were held with the counterparts.

33895 (IAEA/UNDP–THA/85/004-18) **Improving food and agricultural production. Thailand. Fertilizer experiments - data analysis and interpretation of results: Technical report. Report prepared for the Government of the Republic of Thailand.** Nelson, L.A. International Atomic Energy Agency, Vienna (Austria); United Nations Development Programme. 1991. 16p. Project THA/85/004;THA/5/031. Order Number DE94600152. Source: OSTI; NTIS (US Sales Only); INIS.

The emphasis of the mission was the provision of training to the staff of the Department of Agriculture, Government of Thailand, in the analysis and interpretation of data from experiments concerning fertilizer applications in agriculture.

33896 (IAEA/UNDP–THA/85/004-19) **Improving food and agricultural production. Thailand. Mutation breeding of food legumes: Technical report. Report prepared for the Government of the Republic of Thailand.** Oram, R.N. International Atomic Energy Agency, Vienna (Austria); United Nations Development Programme. 1991. 15p. Project THA/85/004;THA/5/031. Order Number DE94600153. Source: OSTI; NTIS (US Sales Only); INIS.

The objectives of the present mission were to assist and advise mutation breeders on the induction, selection, utilization and maintenance of useful mutants in grain legumes, especially in soybean, mungbean, red kidney bean, sugar pea, cowpea and yard-long bean, and to provide consultation to plant breeders.

33897 (IAEA/UNDP–THA/85/004-20) **Improving food and agricultural production. Thailand. Improving the reproductive performance of large and small ruminants in Thailand: Technical report. Report prepared for the Government of the Republic of Thailand.** Vercoe, J.E. International Atomic Energy Agency, Vienna (Austria); United Nations Development Programme. 1991. 33p. Project THA/85/004;THA/5/031. Order Number DE94600181. Source: OSTI; NTIS (US Sales Only); INIS.

This document reports the activities of the expert during a three-week mission to Thailand to discuss work aimed at increasing the reproductive efficiency of cattle and buffaloes. In addition the expert assessed the potential for the introduction of hormonal assays to increase productivity in goats. Discussions focussed on the techniques used, the increase in understanding of the reproductive status of the cattle and buffaloes in the region, the impact of the findings on husbandry, breeding and management priorities, the usefulness of the progesterone test and on what additional research is required.

33898 (IAEA/UNDP–THA/85/004-21) **Improving food and agricultural production. Thailand. Application on monoclonal antibodies for progesterone measurement: Technical report. Report prepared for the Government of the Republic of Thailand.** Butcher, G.W. (AFRC Inst. of Animal Physiology and Genetics Research, Cambridge Research Station, Babraham (United Kingdom)). International Atomic Energy Agency, Vienna (Austria); United Nations Development Programme. 1991. 17p. Project THA/85/004;THA/5/031. Order Number DE94600182. Source: OSTI; NTIS (US Sales Only); INIS.

The duties of the mission were to provide instructions on the maintenance of hybridoma cell lines and their culture and the harvesting of monoclonal antibodies; to assist the counterparts in Thailand to develop work plans for the use of monoclonal antibodies in radioimmunoassay measurements of progesterone; and to assess the need for and feasibility of establishing a laboratory for producing monoclonal antibodies directed against progesterone. The report contains a summary of the activities performed in fulfillment of these duties.

33899 (IAEA/UNDP–THA/85/004-22) **Improving food and agricultural production. Thailand. Improving food and agricultural production with nuclear and related technology: Technical report. Report prepared for the Government of the Republic of Thailand.** Vanderdeelen, J. International Atomic Energy Agency, Vienna (Austria); United Nations Development Programme. 1991. 21p. Project THA/85/004;THA/5/031. Order Number DE94600154. Source: OSTI; NTIS (US Sales Only); INIS.

In the northern and north-eastern regions of Thailand, low agricultural production is due mainly to poor soil conditions and variability in the seasonal rainfall distribution. With respect to the former aspect, phosphorus fertilization is one of the major constraints. The aim of the mission was to provide guidance on the studies addressing the use of naturally occurring rock phosphate deposits or phosphate fertilizer. 9 refs, 3 tabs.

33900 (INIS-mf–13679) **Food irradiation newsletter. V. 17, no. 2.** Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Jul 1993. 55p. Order Number DE94600171. Source: OSTI; NTIS (US Sales Only); INIS.

This issue of the Food Irradiation Newsletter includes reports of a number of activities of the Food Preservation Section of the FAO/IAEA from the final quarter of 1992 to the middle of 1993. In addition there is a summary of food irradiation activities in the USA, an excerpt from the Official Gazette of the French Republic concerning the use of ionizing radiation to treat camembert made from raw milk, and a discussion of the potential for the application of food irradiation in Russia.

33901 (INIS-mf–13681, pp. 65-69) **Radiobiology. Pt. I.** Nuclear Research Inst., Da Lat (Viet Nam). Jan 1991. In *Report of Activities 1986-1990.* 72p. Order Number DE93633556. Source: OSTI; NTIS (US Sales Only); INIS.

A number of studies on aspects of radiobiology of Vietnamese plants and animals are described including effects of different radiations on crop plants, plant nutrition physiology and plant improvement by radioisotope techniques, and application of nuclear and related techniques on cattle and livestock. (N.H.A). 5 figs.

33902 (INIS-mf–13683) **Radiation decontamination of frozen chicks.** Khan, M.; Akhtar, T.; Sattar, A.; Khan, I. Nuclear Inst. for Food and Agriculture, Peshawar (Pakistan). Jul 1992. 2p. Order Number DE94600172. Source: OSTI; NTIS (US Sales Only); INIS.

NIFA annual report 1990-91.

In this report decontamination of frozen chicken has been discussed. The pathogenic bacteria present in poultry meats causes food infectious diseases. The spoilage microorganisms in poultry

meat quickly render the meat unacceptable due to decomposition of the products resulting in off-odour and development of slime. Irradiation (2-5 kGy) and freezing has been found effective in eliminating various pathogens. These combination treatments were tested in local environment. The results indicated that radiation followed by freezing greatly protected quality of poultry meat during storage for 6 months. (A.B.).

33903 (INIS-mf–13684) **Radiosensitivity of red flour beetle tribolium castaneum.** Sattar, A.; Khattak, S.; Hamed, M. Nuclear Inst. for Food and Agriculture, Peshawar (Pakistan). Jul 1992. 3p. Order Number DE94600161. Source: OSTI; NTIS (US Sales Only); INIS.

NIFA annual report 1990-91.

In this report radiosensitivity of red beetle has been discussed. Red flour beetle is the most injurious pest causing great losses to stored grain. Radiation is one of the best tools of insect control. Different radiation doses (50 to 200 krads) were employed for different age groups from 1 to 60 days. It is concluded from these results that 200 krad radiation dose caused 100% mortality in red beetle in all age group. (A.B.).

33904 (INIS-mf–13685) **Radiation decontamination of spices.** Akhtar, T.; Sattar, A.; Khan, M.; Khan, I. Nuclear Inst. for Food and Agriculture, Peshawar (Pakistan). Jul 1992. 3p. Order Number DE94600162. Source: OSTI; NTIS (US Sales Only); INIS.

NIFA annual report 1990-91.

In this report effect of gamma irradiation and storage of fungal infestation and moisture of red chilies and black pepper has has been discussed. The sample were collected from local market and radiation treatment with 8 kGy of gamma rays completely inhibited fungal infestation in both the spices. It was observed that irradiated samples remained uncontaminated throughout storage period of 12 months. Moisture values increased with advanced storage. The contents were highest in the unpacked control samples and lowest irradiated packed samples. (A.B.).

33905 (INIS-mf–13686) **Chickpea improvement: performance of chickpea mutants in micro yield trials at NIFA.** Hassan, S.; Javed, M.A. Nuclear Inst. for Food and Agriculture, Peshawar (Pakistan). Jul 1992. 12p. Order Number DE94600155. Source: OSTI; NTIS (US Sales Only); INIS.

NIFA annual report 1990-91.

Chickpea is an important pulse crop of Pakistan. The premising mutants of varieties C153, C727, C776, K850, ILC195 and ILC482 in advanced generations were tested in four micro yield trials against the check varieties CM-72 and NIFA-88. Several types of mutants of gram crop has been investigated for better yield. Chickpea mutants variety NIFA-88 was approved for general cultivation. (A.B.).

33906 (INIS-mf–13687) **Oilseed brassica improvement through induced mutations.** Shah, S.A.; Ali, I.; Rehman, K. Nuclear Inst. for Food and Agriculture, Peshawar (Pakistan). Jul 1992. 15p. Order Number DE94600156. Source: OSTI; NTIS (US Sales Only); INIS.

NIFA annual report 1990-91.

The improvement in processing and refining technologies of oil seed brassica have now made possible the use of rape seed mustard oil as cooking medium shortening, salad ingredients and in margarine in many countries. Different promising rape seed mutants were tested for yield and other agronomic traits in eight preliminary yields trails and results of these trails are presented in this report. Three varieties of rape seeds were subjected to 80, 100, 120 krads and two varieties of mustard were treated 60, 80, 100 krads dose of gamma rays. (A.B.).

33907 (INIS-mf–13688) **Electrophoretic studies on rape seed proteins.** Chaudry, M.A.; Starr, A.; Bibi, N. Nuclear Inst. for Food and Agriculture, Peshawar (Pakistan). Jul 1992. 5p. Order Number DE94600157. Source: OSTI; NTIS (US Sales Only); INIS.

NIFA annual report 1990-91.

Electrophoresis is a technique which separates biological molecules on the basis of charge and mass properties. The technique is used for separation, purification, characterization and identification of molecules/compounds. Two major objectives for applications of electrophoresis have been studied in this report i.e. characterization of rape seed proteins and enzymes and identification of rape seed cultivars by polyacrylamide gel electrophoresis (PAGE). Gamma irradiation is being successfully used to create genetic variability and germination which brought about definite changes in the rape seed proteins reflected in different bands. These differences could be used to study variability in crop plants. (A.B.).

33908 (INIS-mf–13689) **Irradiation processing of potatoes, onions and garlic.** Jan, M.; Starr, A.; Wahid, M.; Ahmad, A.; Khan, I. Nuclear Inst. for Food and Agriculture, Peshawar (Pakistan). Jul 1992. 4p. Order Number DE94600173. Source: OSTI; NTIS (US Sales Only); INIS.

NIFA annual report 1990-91.

In this report, studies have been conducted on irradiation preservation of potatoes, onions and garlic involving different varieties, harvesting season and storage life. As a result of these investigations, optimum conditions were established for each crop. The effect of irradiation and storage on sprouting, rottage and weight loss of potatoes is presented. The sprouting initiated in the unirradiated samples after 2 months reaching 51, 80 and 100% on 4, 5 and 6 months storage respectively. Weight losses were observed in the irradiated and unirradiated samples. (A.B.).

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

Refer also to citation(s) 33380

5601 Radiation Effects

Refer also to citation(s) 32531, 32533, 32543, 32545, 32554, 32564, 32826, 32918, 32926, 33351, 33484, 33655, 33683, 33785, 33799, 33807, 33844, 33858, 33901, 34413

33909 (AEA-D and R–0508) **Decontamination and free release of reactor pond furniture.** Burke, S.P.; Sanders, M.J. AEA Decommissioning and Radwaste, Winfrith (United Kingdom). 1993. 10p. (CONF-930205–: Waste management '93, Tucson, AZ (United States), 28 Feb - 4 mar 1993). Order Number DE94600191. Source: OSTI; NTIS (US Sales Only); INIS.

As part of the Stage 1 decommissioning project for the Steam Generating Heavy Water Reactor (SGHWR) at AEA Technology's Winfrith site in the UK, the 20 fuel racks in the fuel pond are to be removed. At Winfrith, considerable experience of waste disposal via the free release (below regulatory concern) route has been built up. Using a redundant rack, a trial was carried out to assess the technical and economic feasibility of the decontamination/free release route. An electrochemical process was employed. The trial successfully demonstrated technical feasibility, and an economic assessment concluded that the route can be justified financially. Therefore a decision was taken to dispose of all the racks by decontamination and free release. (Author).

33910 (ANL/CBM/CP–80231) **c-jun gene expression in human cells exposed to either ionizing radiation or hydrogen peroxide.** Collart, F.R.; Horio, M.; Huberman, E. Argonne National Lab., IL (United States). Jun 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930454–3: International seminar on molecular mechanisms in radiation mutagenesis and carcinogenesis, Doorwerth (Netherlands), 19-22 Apr 1993). Order Number DE93017436. Source: OSTI; NTIS; INIS; GPO Dep.

We investigated the role of reactive oxygen intermediates (ROIs) and protein kinase C (PKC) in radiation- and H_2O_2-evoked c-jun gene expression in human HL-205 cells. This induction of c-jun gene expression could be prevented by pretreatment of the cells with Nacetylcysteine (an antioxidant) or H7 (a PKC and PKA inhibitor) but not by HA1004, a PKA inhibitor, suggesting a role for ROIs and PKC in mediating c-jun gene expression. We also investigated potential differences in c-jun gene expression in a panel of normal and tumor cells untreated or treated with ionizing radiation

or H_2O_2. Treatment with radiation or H_2O_2 produced a varied response, from some reduction to an increase of more than an order of magnitude in the steady-state level of c-jun mRNA. These data indicate that although induction of c-jun may be a common response to ionizing radiation and H_2O_2, this response was reduced or absent in some cell types.

33911 (CONF-930607–1) **The Department of Energy's radon testing program.** Scott, H.L. (USDOE, Washington, DC (United States)); Dudney, C.S.; Wilson, D.L.; Gammage, R.B. Oak Ridge National Lab., TN (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 1. international workshop on indoor radon remedial action; Rimini (Italy); 27 Jun - 2 jul 1993. Order Number DE93017859. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy recently completed an initial survey of indoor radon in its buildings in response to Public Law 100–551, the Indoor Radon Abatement Act of 1988. Other federal agencies have also conducted radon surveys. This paper presents an overview of the results from radon testing of several thousand buildings ranging from 100 m^2 to over 10,000 M^2 in size. In addition, we have examined results from groups of buildings, classified according to ventilation and usage characteristics. So far, there is no apparent difference among building classes. The paper also discusses our proposal for phased radon surveys. We suggest that first-phase results can be used to identify facilities with radon problems. In the second phase, we suggest measurements be made at a much higher sampling density at facilities with radon problems. The results of the second phase are expected to identify all buildings in need of mitigation.

33912 (CONF-931107–3) **Effect of EMP fields on cell membrane potentials.** Gailey, P.C.; Easterly, C.E. Oak Ridge National Lab., TN (United States). [1993]. 2p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Nuclear science symposium; San Francisco, CA (United States); 2-5 Nov 1993. Order Number DE93015819. Source: OSTI; NTIS; GPO Dep.

A simple model is presented for cell membrane potentials induced during exposure to electromagnetic pulse (EMP). Using calculated values of internal electric field strength induced during EMP exposure, the model predicts that cell membrane potentials of about 100 mV may be induced for time frames on the order of 10 ns. Possible biological effects of these potentials including electroporation area discussed.

33913 (DOE/ER/60390–T2) **Electron transport calculations with biomedical and environmental applications.** National Inst. of Standards and Technology, Gaithersburg, MD (United States). [1990]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AI05-86ER60390. Order Number DE93019590. Source: OSTI; NTIS; INIS; GPO Dep.

The general objective is to carry out studies of radiation interactions with matter, and of radiation transport in bulk media, in order to generate basic radiological physics information needed as input for: Biomedical radiation dosimetry, Assessment of radiation hazards in nuclear technology, Modeling of biological radiation action. This work includes the development of transport-theoretic methods, the compilation and critical evaluation of the underlying single-scattering cross sections, and the application of the transport methods to radiological physics problems.

33914 (DOE/ER/61256–T1) **Role of x-ray-induced transcripts in adaptive responses following x-rays: Progress report, Year 2.** Michigan Univ., Ann Arbor, MI (United States). Dept. of Atmospheric and Oceanic Science. [1993]. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER61256. Order Number DE93040079. Source: OSTI; NTIS; GPO Dep.

I will describe our recent data in which we have extracted and purified a sufficient amount of RNA from primed and unprimed U1-Mel cells to begin the search for new genes which are modulated by priming or high dose irradiation during the establishment and/or challenge of adapted cells, respectively. Gene transcripts which are altered during ASRs now include alterations in xip5 (a gene with homology to human growth hormone), xipl2 (a gene with homology to human angiogenesis factor and a gene which may be involved in apoptosis due to its possible RNase activity), cyclin A (which is altered in primed cells only after a high dose of ionizing radiation), cyclin B (which is also altered in a similar manner as cyclin A), p53 (a tumor suppressor gene involved in cell division control in G_1 following ionizing radiation), and glutathionine S transferase-pi (a gene product which has been demonstrated to be involved in DNA repair and redox cycling). In contrast, the remaining xip CDNA clones [i.e., xip1-4,6-11, which were isolated following high dose ionizing radiation exposure to human U1-Mel cells], Prad-1 (a gene involved in cell cycle controlling events at the G_1 portion of the cell cycle), 36B4 (a gene involved in homeostasis), and cdc2 (a gene involved in the regulation of the S-phase portion of the cell cycle), were not altered following ionizing radiation, either during the establishment or challenge of adapted human cells.

33915 (DOE/FTR–93016213) **Journal of the Citizen Ambassador Program: Nuclear protection delegation to Russia and Ukraine: Foreign trip report, August 3–17, 1992.** Christiansen, H.D. USDOE Idaho Operations Office, Idaho Falls, ID (United States). 29 Jun 1993. 125p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93016213. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document provides details of the activities of the Citizen Ambassador Program Nuclear Protection Delegation which convened August 3, 1992 in New York City. Biographical information is provided for the delegation members.

33916 (DOE/FTR–93016757) **Travel to France to coordinate international study of cancer risk among nuclear workers: Foreign trip report, June 17–July 3, 1993.** Fix, J.J. Pacific Northwest Lab., Richland, WA (United States). 8 Jul 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93016757. Source: OSTI; NTIS (US Sales Only); GPO Dep.

IARC is coordinating an international collaborative study of cancer risk among nuclear industry workers involving eleven countries. Comparability of recorded dose is an important consideration in the conduct of this study. Because the traveler has been extensively involved in previous combined analyses of data from nuclear worker studies, and because the new study utilizes similar methods to those used in previous study, there was strong interest by IARC for participation of the traveler in this new study to maintain continuity between the studies. The purpose of this trip was to participate in general meetings between the epidemiology and dosimetry subcommittees and to chair working sessions of the dosimetry subcommittee. During a previous meeting of the two subcommittees in December 1991, a protocol for the study was adopted, but detailed procedures remained to be worked out, and were developed during this meeting.

33917 (DOE/FTR–93016758) **Travel to France to participate in epidemiology subcommittee meeting of study on cancer risk among nuclear industry workers: Foreign trip report, June 22–26, 1993.** Gilbert, E.S. Sr. Pacific Northwest Lab., Richland, WA (United States). 28 Jun 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93016758. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Purpose of Trip: IARC is coordinating an international collaborative study of cancer risk among nuclear industry workers involving eleven countries. Because the traveler has been extensively involved in previous combined analyses of data from nuclear worker studies. and because the new study utilizes similar methods to those used in previous study, there was strong interest by IARC for participation of the traveler in this new study to maintain continuity between the studies. Thus, the purpose of this trip was to participate in a meeting of the epidemiology subcomittee meeting for the new international collaborative study. The decision to go forth with the study was made at a meeting in June 1988, at which the epidemiology and dosimetry subcommittees were appointed. At a previous meeting of the two subcommittees in December 1991, a protocol for the study was adopted, but detailed procedures remained to be worked out, and were developed at this meeting.

33918 (DOE/FTR–93017245) **Travel to France to confer on technological studies and advances in radioactive particulate monitoring for the work place: Foreign trip report, March 24–April 3, 1993.** Troyer, G.L. Westinghouse Hanford Co., Richland, WA (United States). Apr 1993. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. Order Number DE93017245. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The conference was a result of an invitation by French counterparts with interest in direct sharing of information on air sampling, instrument placement, regulatory guidelines of each country, and recent technology developments regarding personnel monitoring as applied to various work place situations. The visit opened with two days of presentations by representatives of both the DOE and CEA showing results of activities in key areas. The CEA identified regulatory documents similar to US orders and federal regulations. These were,comparatively discussed and highlights are described. Each of the US delegates presented summaries of their activities relating to work place radioactive air particulate monitoring. These presentations included sampling efficiency studies, data networking, placement of samplers, methods of suppressing radon interference, and instrument calibration methods. The remainder of the visit involved specific site visits at various research and operational facilities. Radiation protection practices were observed and discussed for each of the situations. Included in the tours were demonstrations of where the instruments are placed, how data are managed and how the instruments are tested and operated.

33919 (DOE/ID–12082(92)) **The Idaho National Engineering Laboratory Site environmental report for calendar year 1992.** Hoff, D.L.; Mitchell, R.G.; Moore, R.; Bingham, L. USDOE Idaho Operations Office, Idaho Falls, ID (United States). Radiological and Environmental Sciences Lab. Jun 1993. 129p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93018935. Source: OSTI; NTIS; GPO Dep.

The results of the various monitoring programs for 1992 indicate that most radioactivity from the INEL operations could not be distinguished from worldwide fallout and natural radioactivity in the region surrounding the INEL Site. Although some radioactive materials were discharged during Site operations, concentrations and doses to the surrounding population were of no health consequence and were far less than State of Idaho and Federal health protection guidelines. The first section of the report summarizes INEL activities related to compliance with environmental regulations and laws for Calendar Year 1992 and January 1 through April 1, 1993. The major portion of the report summarizes results of the RESL environmental surveillance program, which includes the collection of foodstuffs at the INEL boundary and distant offsite locations, and the collection of air and water samples at onsite locations, offsite boundary, and distant locations. The report also compares and evaluates the sample results to appropriate Federal regulations and standards and discusses implications, if any. The USGS ground-water monitoring program is briefly summarized, and data from USGS reports are included in maps showing the spread of contaminants. Effluent monitoring and nonradiological drinking water monitoring performed by INEL contractors are discussed briefly, and data are summarized in tables.

33920 (ETDE-IT–93-201) **Are somatic effects of low neutron doses detectable in vivo?.** Di Majo, V. (ENEA, Casaccia (Italy). Area Energia Ambiente e Salute); Rebessi, S.; Coppola, M.; Saran, A.; Pazzaglia, S.; Covelli, V. 1992. 4p. (CONF-920720–3: International conference on low dose irradiation and biological defense mechanisms, Kyoto (Japan), 12-16 Jul 1992). Order Number DE93522946. Source: OSTI; NTIS (US Sales Only).

In recent years the biological effects of low radiation doses and dose rates has caused growing concern, as proved by the lower dose limits newly recommended for radiological protection. Risk estimates rely substantially on the investigation of in vivo effects at low doses and, in absence of direct human data, as it occurs for high LET radiation, no substitutes to studies of tumor induction and life shortening in the experimental animals can easily be found. However, data from in vivo experimentation in the so-called low-dose region do not appear to be adequate as yet, so that the problem of the shape of the dose-effect relationship at very low doses still remains difficult to solve. This was considered a sound reason to carry out, at our laboratory, a complete observation of life span and late pathology on mice through large scale experiments with graded low doses of neutrons. Useful information on some specific aspects of the biological action of radiation can be derived from in vitro studies, using well characterized model systems, in which test conditionsare more definite and results can be acquired in short time periods.

33921 (ETDE-IT–93-209) **Cytogenetic effects (micronuclei) on human and canine lymphocytes and on Chinese hamster CL1/AF cell line after in vitro irradiation: Comparative analysis.** Catena, C. (ENEA, Casaccia (Italy). Area Energia Ambiente e Salute); Conti, D.; Villani, P.; Archillei, R.; Righi, E. 1992. 22p. (In Italian). Order Number DE93522968. Source: OSTI; NTIS (US Sales Only).

Radiation protection researchers are currently investigating methods to estimate by advanced biological dosimetry techniques the absorbed dose of individuals, especially in the case of accidental exposure, to compare the radiosensitivities of different individuals. This paper reports the results obtained to date by ENEA (Italian Agency for New Technology, Energy and Environment) in its research efforts aimed at the development of a reverse prediction micronuclei analysis method in which doses are estimated by the measurement of induced cytogenetic effects, and the development of a radiosensitivity comparative analysis technique involving the use of human lymphocytes irradiated in vitro in the presence of 3-aminobenzamide (3AB). This (3AB) is an enzyme inhibitor to processes which become particularly active after exposure to ionizing radiations and which is involved in the repair of radioinduced DNA damage. It is hoped that the experimental data obtained through the use of the micronuclei test on canine and human lymphocytes, as well as, on an in vitro irradiated Chinese hamster CL1/AF cell line, in combined irradiation and 3AB inhibitor treatments, will give useful information on the inherent response capability of lymphocytes.

33922 (ETDE-IT–93-210) **Qualification of personal dosimetry services in Italy: Procedures and results.** Cavallini, A. (ENEA, Bologna (Italy). Area Energia Ambiente e Salute); Klamert, V.; Busuoli, G. 1993. 20p. (CONF-9305175–1: Individual monitoring of ionizing radiation: the impact of recent ICRP and ICRU publications, Villigen (Germany), 5-7 May 1993). Order Number DE93522974. Source: OSTI; NTIS (US Sales Only).

About 80 dosimetry services, processing over 2,000,000 dosemeters yearly, operate in Italy today. As no official guide-lines on the performance of personal dosimetry services have been established in Italy, a Working Group (called ENEA (Italian Agency for Energy, New Technologies and the Environment)-EDP, Personal Dosimetry Experts) has been made up in the framework of ENEA institutional role, to test, on voluntary basis, the reliability of the services. The Group published a paper on the test program: it deals first with each service's methods, facilities, instruments, staff. organization and also with irradiation tests in the 5.2 10^{-6} - 1.3 10^{-3} C/kg exposure range at different X and gamma ray energies. The test program follows the international standards, with due attention to the European Community recommendations. At year's end (1992), 52 services, gathering 56 different types of dosemeters, have been tested in nine sessions. The results of the tests and the evaluation methods of the tested services are discussed.

33923 (ETDE-IT–93-211) **Local recording practice in dose record keeping in Italy.** Litido, M. (ENEA, Bologna (Italy). Area Energia Ambiente e Salute); Cavallini, A.; Chili, L. 1993. 18p. (CONF-9305175–2: Individual monitoring of ionizing radiation: the impact of recent ICRP and ICRU publications, Villigen (Germany), 5-7 May 1993). Order Number DE93522975. Source: OSTI; NTIS (US Sales Only).

At present, an Italian national dosimetric data bank, maintained by ENEA (National Agency for New Technologies, Energy and Environment), collects information on 50, 000 Italian workers exposed to external ionizing radiation. This paper briefly outlines Italian regulatory aspects about dose record keeping and presents the results of an analysis that compares doses of all the monitored workers in the data bank to those of a small sample of workers whose data are specifically validated by health physicists. The differences in the two dose distributions are analyzed and interpreted

in the light of radiation protection practice and regulatory applications enforced in Italy.

33924 (HW–19296) **P-10 research program in biology.** Thompson, R.C. Hanford Works, Richland, WA (United States). 23 Oct 1950. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93017357. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Early this year recommendations for biological research with tritium were outlined by M. E. Getzendaner in document EW-17059. Since then work on many of the preliminary experiments suggested in that document has been and further thought has been given to design a research program to secure the information needed for evaluation of the tritium hazards. It seems desirable at this time to reformulate the projected research more extensively. This document will indicate only the scope of desirable investigations, without attempting to spell out in detail the experimental procedures to be followed. Proposed investigations are studies of water metabolism; studies of hydrogen metabolism; studies with tritium labelled compounds of biological interest; and studies of the biological effect of tritium radiations. The problems outlined under these headings were chosen on the basis of general scientific interest. In most if not all cases, however, the application to radiation hazard evaluation and control is obvious.

33925 (INIS-JP–008, pp. 65-70) **Ionizing radiation, genetic risks and radiation protection.** Sankaranarayanan, K. (Rijksuniversiteit Leiden (Netherlands). Lab. voor Stralengenetica en Chemische Mutagenese). Japan Atomic Energy Research Inst., Tokyo (Japan). 1992. 558p. (CONF-9203223–: International conference on radiation effects and protection, Mito (Japan), 18-20 Mar 1992). In *Proceedings of the international conference on radiation effects and protection.* Order Number DE93764166. Source: OSTI; NTIS; INIS.

With one method of risk estimation, designed as the doubling dose method, the estimates of total genetic risk (i.e., over all generation) for a population continuously exposed at a rate of 0.01 Gy/generation of low LET irradiation are about 120 cases of Mendelian and chromosomal diseases/10^6 live births and about the same number of cases for multifactorial diseases (i.e., a total of 240 cases/10^6). These estimates provide the basis for risk coefficients for genetic effects estimated by ICRP (1991) in its Publication 60. These are: 1.0%/Sv for the general population (which is 40% of 240/10^6/0.01 Gy), and 0.6%/Sv for radiation workers (which is 60% of that for the general population). The results of genetic studies carried out on the Japanese survivors of A-bombs have shown no significant adverse effects attributable to parental radiation exposures. The studies of Gardner and colleagues suggest that the risk of leukaemia in children born to male workers in the nuclear reprocessing facility in Sellafield, U.K., may be increased. However, this finding is at variance with the results from the Japanese studies and at present, does not lend itself to a simple interpretation based on radiobiological principles. In the light of recent advances in the molecular biology of naturally-occurring human Mendelian diseases and what we presently know about multifactorial diseases, arguments are advanced to support the thesis that (i) current risk estimates for Mendelian diseases may be conservative and (ii) an overall doubling dose for all adverse genetic effects may be higher than the 1 Gy currently used (i.e., the relative risks are probably lower). (author).

33926 (INIS-JP–008, pp. 71-76) **The biological basis for dose limitation to the skin.** Fry, R.J.M. (Oak Ridge National Lab., TN (United States). Biology Div.). Japan Atomic Energy Research Inst., Tokyo (Japan). 1992. 558p. (CONF-9203223–: International conference on radiation effects and protection, Mito (Japan), 18-20 Mar 1992). In *Proceedings of the international conference on radiation effects and protection.* Order Number DE93764166. Source: OSTI; NTIS; INIS.

Ionizing radiation may cause deterministic effects and cancer. It has been the policy to base dose limits for radiation protection of the skin on the prevention of deterministic effects (1). In the case of cancer in general, dose limitation for radiation protection is based on limiting excess cancer mortality to low levels of radiation. Since skin cancers are seldom lethal, the general radiation protection standards will protect against an increase in excess mortality from skin cancer. However, with the dose limits selected to prevent deterministic effects, there is a significant probability of an excess incidence of skin cancer occurring as a result of exposure during a working lifetime. The induction of skin cancer by radiation is influenced significantly by subsequent exposure to ultraviolet radiation (UVR) from sunlight. This finding raises not only interesting questions about the mechanisms involved, but also about the differences in risk of skin cancer in different populations. The amount and distribution of melanin in the skin determines the degree of the effect of UVR. This paper discusses the mechanisms of the induction of both deterministic and stochastic effects in skin exposed to radiation in relation to radiation protection. (author).

33927 (INIS-JP–008, pp. 77-79) **Studies of skin cancer and thyroid tumors after irradiation of the head and neck.** Shore, R.E. (New York Univ., NY (United States). Medical Center); Moseson, M.; Hildreth, N. Japan Atomic Energy Research Inst., Tokyo (Japan). 1992. 558p. (CONF-9203223–: International conference on radiation effects and protection, Mito (Japan), 18-20 Mar 1992). In *Proceedings of the international conference on radiation effects and protection.* Order Number DE93764166. Source: OSTI; NTIS; INIS.

Two longitudinal studies of children given medical X-irradiation to the head and neck are described, one of 2,650 infants who received x-ray treatment for enlarged thymus glands and the other of 2,200 children who received x-ray treatment for tinea capitis (ringworm of the scalp). The thymus study showed a dose-related excess of thyroid cancer and a long period of excess risk. The tinea study also showed an excess of thyroid tumors even though the thyroid dose was only about 0.06 Gy. An excess of non-melanotic skin cancers has also occurred in the tinea study, but no evidence for excess malignant melanomas. The skin cancer excess is not evident among blacks in the study, and, among Caucasians, it is more prominent among those with a light complexion. This suggests that host-susceptibility to ultraviolet effects is an important modifier of skin cancer risk from ionizing irradiation. (author).

33928 (INIS-JP–008, pp. 80-85) **Health risks of atomic bomb survivors: The experiences of those exposed in utero or early in childhood.** Yoshimoto, Y. (Radiation Effects Research Foundation, Hiroshima (Japan)); Soda, M.; Mabuchi, K. Japan Atomic Energy Research Inst., Tokyo (Japan). 1992. 558p. (CONF-9203223–: International conference on radiation effects and protection, Mito (Japan), 18-20 Mar 1992). In *Proceedings of the international conference on radiation effects and protection.* Order Number DE93764166. Source: OSTI; NTIS; INIS.

At the Atomic Bomb Casualty Commission and its successor organization, the Radiation Effects Research Foundation, mortality and morbidity surveys have been continually carried out on about 1,800 persons exposed in utero to the atomic bombings of Hiroshima and Nagasaki. Although the effect of radiation exposure was marked enough to permit observation of a dose-response relationship in the 30 known cases of severe mental retardation among the in utero-exposed, the association between in utero exposure and cancer risk is still uncertain. Based on data for all cancers from 1950 through 1984 for the in utero-exposed, the excess risk per 10,000 person-year-Gy was 6.57 and the relative risk at 1 Gy was 3.77. For the recent years 1985-89, there was no evident excess of cancer risk. During the remaining lifetime, it seems unlikely that any great excess of leukemia will appear. As for the risk of solid tumors, further follow up is in progress. The 1950-89 findings for cancer risk among the in utero-exposed will be compared with cancer risk among A-bomb survivors who were less than 10 years old at the time of the bombings. (author).

33929 (INIS-JP–008, pp. 86-91) **Statistical methods for site-specific analysis of cancer among the A-bomb survivors.** Pierce, D.A. (Oregon State Univ., Corvallis, OR (United States)); Preston, D.L. Japan Atomic Energy Research Inst., Tokyo (Japan). 1992. 558p. (CONF-9203223–: International conference on radiation effects and protection, Mito (Japan), 18-20 Mar 1992). In *Proceedings of the international conference on radiation effects and protection.* Order Number DE93764166. Source: OSTI; NTIS; INIS.

Statistical methods are presented for joint, or simultaneous, analysis of the risks of several types of cancer for the A-bomb survivors. Previous analyses have been made either for all cancers except leukemia together, or have been done separately by cancer type. Either of these approaches has serious limitations, and the aim of joint analysis is to overcome these, while taking advantage of the strengths of each. The primary advantage of joint analysis is that models for risks of various cancer types can have some parameters in common, and others which are type-specific. This serves to overcome difficulties due to the limited data on specific cancer types. It also provides for significant tests comparing both type-specific risks and type-specific effects of modifying factors such as sex and age. These methods are exemplified here by joint analysis of three classes of cancer considered by the BEIR-V committee: (i) respiratory, (ii) digestive, and (iii) other cancers, excluding leukemia and breast cancer. The primary aim is to illustrate the general advantages of joint analyses, but in addition some comparison is made between the results of such joint analyses and the conclusions drawn by BEIR-V committee from separate analyses. (author).

33930 (INIS-JP–008, pp. 99-102) **The evaluation of the Chernobyl reactor accident by the help of the Hungarian Surveillance of Germinal Mutations.** Czeizel, A.E. (National Inst. of Hygiene, Budapest (Hungary)); Elek, Cs.; Susanszky, E. Japan Atomic Energy Research Inst., Tokyo (Japan). 1992. 558p. (CONF-9203223–: International conference on radiation effects and protection, Mito (Japan), 18-20 Mar 1992). In *Proceedings of the international conference on radiation effects and protection.* Order Number DE93764166. Source: OSTI; NTIS; INIS.

The germinal mutagenic consequences or radioactive fall-out deposition from the Chernobyl accident in Hungary was evaluated in the ongoing program on the population-based Hungarian Surveillance of Germinal Mutations. The surveillance is based on three groups of indicator conditions: 15 sentinel anomalies (indicators of germinal dominant gene mutations), Down syndrome (an indicator of germinal numerical and structural chromosomal mutations) and unidentified multiple congenital abnormalities (indicators of germinal dominant gene and chromosomal mutations). Cases with indicator conditions were selected from the material of the Hungarian Congenital Abnormality Registry. After the diagnostic accuracies were checked, familial and sporadic cases were separated and only the latter group was evaluated for evidence of new mutations. The analysis did not reveal any measurable germinal mutagenic effects of the Chernobyl reactor accident in Hungary. (author).

33931 (INIS-JP–008, pp. 103-107) **Leukemia incidence in the atomic bomb survivor Life Span Study, 1950 - 87.** Preston, D.L. (Radiation Effects Research Foundation, Hiroshima (Japan)); Mabuchi, K.; Kusumi, S.; Izumi, S. Japan Atomic Energy Research Inst., Tokyo (Japan). 1992. 558p. (CONF-9203223–: International conference on radiation effects and protection, Mito (Japan), 18-20 Mar 1992). In *Proceedings of the international conference on radiation effects and protection.* Order Number DE93764166. Source: OSTI; NTIS; INIS.

The Radiation Effects Research Foundation (RERF) is currently preparing a series of reports on cancer incidence in the Life Span Study (LSS) cohort of atomic bomb survivors for the period from 1950 to 1987. One of these reports will present analyses of the data on the risk of hematopoietic cancers including leukemia, malignant lymphoma, and multiple myeloma. These analyses add an additional 11 years of follow-up to the previous comprehensive analysis of the LSS leukemia data. In this presentation, these data are presented and the methods being used modeling the leukemia risks are outlined. An analysis of the leukemia data pooled over subtypes will be used to illustrate these methods. It is shown that the data suggest a non-linear, concave upward dose response and that the temporal pattern of the radiation-induced excess absolute risks (EARs) depends on age-at-exposure and sex. There is no evidence of city differences in the EAR in this pooled analysis. The results suggest that the EARs for the youngest survivors were initially much higher and have declined more rapidly than those for older survivors. The same general pattern is seen both sexes, but the initial peak incidence is somewhat lower and the rate of decline less rapid for women than for men. (author).

33932 (INIS-JP–008, pp. 108-113) **Effects of dose, dose-rate and fraction on radiation-induced breast and lung cancers: The Canadian fluoroscopy study.** Howe, G.R. (Toront Univ., ON (Canada). Dept. of Preventive Medicine and Biostatistics). Japan Atomic Energy Research Inst., Tokyo (Japan). 1992. 558p. (CONF-9203223–: International conference on radiation effects and protection, Mito (Japan), 18-20 Mar 1992). In *Proceedings of the international conference on radiation effects and protection.* Order Number DE93764166. Source: OSTI; NTIS; INIS.

Recent results from a large Canadian epidemiologic cohort study of low-LET radiation and cancer will be described. This is a study of 64,172 tuberculosis patients first treated in Canada between 1930 and 1952, of whom many received substantial doses to breast and lung tissue from repeated chest fluoroscopies. The mortality of the cohort between 1950 and 1987 has been determined by computerized record linkage to the National Mortality Data Base. There is a strong positive association between radiation and breast cancer risk among the females in the cohort, but in contrast very little evidence of any increased risk in lung cancer. The results of this and other studies suggest that the effect of dose-rate and/or fractionation on cancer risk may will differ depending upon the particular cancer being considered. (author).

33933 (INIS-JP–008, pp. 115-122) **Histological types of lung cancer in Japanese A-bomb survivors and Colorado plateau uranium miners.** Land, C.E. (National Cancer Inst., Bethesda, MD (United States)). Japan Atomic Energy Research Inst., Tokyo (Japan). 1992. 558p. (CONF-9203223–: International conference on radiation effects and protection, Mito (Japan), 18-20 Mar 1992). In *Proceedings of the international conference on radiation effects and protection.* Order Number DE93764166. Source: OSTI; NTIS; INIS.

In an investigation of possible differences between lung cancers induced by inhaled radon daughters and external gamma ray and neutrons, a blind pathology panel review was carried out of tissue slides from lung cancer cases diagnosed among 108 Japanese A-bomb survivors and 92 American uranium miners. Slides were selected on the basis of radiation exposure, smoking history, sex, age, and source and quality of pathology material. Consensus diagnoses were obtained with respect to principal subtype, including squamous cell cancer, small cell cancer, adenocarcinoma, and less frequent subtypes. The results were analyzed in terms of population, radiation dose, and smoking history. As expected, the proportion of squamous cell cancer was positively related to smoking history in both populations. The relative frequencies of small cell cancer and adenocarcinoma were very different in the two populations, but this difference was adequately accounted for by differences in radiation dose (more specifically, dose-based relative risk estimates based on published risk coefficients). Data for the two populations conformed to a common pattern, in which radiation-induced cancers appeared more likely to be of the small-cell subtype, and less likely to be adenocarcinomas. No additional explanation in terms of radiation quality (alpha particles vs. gamma rays), uniform or local irradiation, inhaled vs. external radiation source, or other population differences, appeared to be required. (author).

33934 (INIS-JP–008, pp. 129-134) **Un-repairable DNA damage in cell due to irradiation.** Yoshii, Giichi (Kansai Medical Univ., Moriguchi, Osaka (Japan)). Japan Atomic Energy Research Inst., Tokyo (Japan). 1992. 558p. (CONF-9203223–: International conference on radiation effects and protection, Mito (Japan), 18-20 Mar 1992). In *Proceedings of the international conference on radiation effects and protection.* Order Number DE93764166. Source: OSTI; NTIS; INIS.

Radiation-induced cell reproductive deactivation is caused by damage to DNA. In a cell, cellular DNA radical reacts with diffusion controlled rate and generates DNA peroxide radical. The chemical repair of DNA radical with hydrogen donation by thiol competes with the reaction of oxygen with same radicals in the DNA molecules. From the point reaction rates, the prolongation of radical life time is not as great as expected from the reduction in the glutathione content of the cell. This indicates that further reducting compounds (protein bound thiol) are present in the cell. The residual radicals are altered to strand breaks, base damages and so on.

The effective lesions for a number of endpoints is un-repaired double strand break, which has been discovered in a cluster. This event gives risk to high LET radiation or to a track end of X-rays. For X- or electron irradiations the strand breaks are frequently induced by the interactions between sublesions on two strands in DNA. A single strand break followed by radical action may be unstable excited state, because of remaining sugar radical action and of having negative charged phosphates, in which strands breaks will be rejoined in a short time to stable state. On the same time, a break in the double helix will be immediately produced if two breaks are on either or approximately opposite locations. The formation of a double strand break in the helix depends on the ion strength of the cell. The potassium ions are largely released from polyanionic strand during irradiation, which results in the induction of denatured region. Double strand break with the denatured region seems to be un-repairable DNA damage. (author).

33935 (INIS-JP–008, pp. 135-139) **Radiation effects on DNA methylation in mice.** Komura, J. (Tohoku Univ., Sendai (Japan). School of Medicine); Kurishita, A.; Miyamura, Y.; Ono, T.; Tawa, R.; Sakurai, H. Japan Atomic Energy Research Inst., Tokyo (Japan). 1992. 558p. (CONF-9203223–: International conference on radiation effects and protection, Mito (Japan), 18-20 Mar 1992). In *Proceedings of the international conference on radiation effects and protection.* Order Number DE93764166. Source: OSTI; NTIS; INIS.

Effects of ionizing radiation on DNA methylation in liver, brain and spleen were examined by high performance liquid chromatography (HPLC). The total methylated cytosine level in the genome was reduced within 8 hours after 3.8 Gy of irradiation in liver of adult mice. But no appreciable effect was observed in brain and spleen. When mice were irradiated at newborn, liver DNA revealed no change in methylated cytosine level. Even though slight effects of radiation were detected in he methylation of the c-myc and c-fos genes, they were only temporary and no long-term effects were observed. These data suggest that the effect of radiation on DNA methylation in vivo is not prevailing a DNA damage, but rather influenced much through biological parameters. (author).

33936 (INIS-JP–008, pp. 140-145) **Molecular nature of X-ray-induced mutations compared with that of spontaneous ones in human c-hprt gene integrated into mammalian chromosomal DNA.** Kimura, Hiroshi (Shiga Univ. of Medical Sciences, Otsu (Japan)); Kato, Takesi. Japan Atomic Energy Research Inst., Tokyo (Japan). 1992. 558p. (CONF-9203223–: International conference on radiation effects and protection, Mito (Japan), 18-20 Mar 1992). In *Proceedings of the international conference on radiation effects and protection.* Order Number DE93764166. Source: OSTI; NTIS; INIS.

X-ray-induced mutations were analysed at molecular levels in comparison with spontaneous mutations. Altered sequences were determined tentatively of 30 independent X-ray-induced mutations in a cDNA of the human hprt gene which was integrated into mammalian chromosome as a part of a shuttle vector. Mutations consisted of base substitutions (37 %), frameshifts (27 %), deletions (27 %) and others (10 %). All these mutational events were distributed randomly over the gene without there being hot spots. The spectrum and distribution of X-ray-induced mutations resembled those of spontaneous mutations. Among base substitutions, transversions were predominant and base substitution mutations occurred more at A:T sites than at G:C sites, which is also the case in spontaneous mutations. Most of the frameshift and deletion mutations induced by X-rays, as well as those spontaneously arising, were characterized by the existence of short direct repeats of several identical bases in a row at the sites of the mutations. A slippage misalignment mechanism in replication well accounts for the generation of these classes of mutations. Judging from the data accumulated so far, it can be concluded that X-ray-induced mutations at molecular levels are similar to those spontaneously occurring. (author).

33937 (INIS-JP–008, pp. 146-150) **BCR-ABL fusion genes are inducible by X-irradiation in vitro.** Ito, Takashi (Radiation Effects Research Foundation, Hiroshima (Japan)); Seyama, Toshio; Mizuno, Terumi; Hayashi, Tomonori; Nakamura, Nori; Akiyama, Mitoshi; Dohi, Kiyohiko. Japan Atomic Energy Research Inst., Tokyo (Japan). 1992. 558p. (CONF-9203223–: International conference on radiation effects and protection, Mito (Japan), 18-20 Mar 1992). In *Proceedings of the international conference on radiation effects and protection.* Order Number DE93764166. Source: OSTI; NTIS; INIS.

The Philadelphia chromosome consists of a reciprocal translocation between the ABL oncogene at chromosome 9q34 and the BCR gene at chromosome 22q resulting in the expression of chimeric BCR-ABL mRNAs specific to chronic myelogenous leukemia (CML). The presence of the fusion genes can be detected with high specificity and sensitivity by means of reverse transcription and polymerase chain reaction. Using this assay, it was possible to detect BCR-ABL fusion genes induced among HL60 cells after 100 Gy of X-irradiation in vitro. A total of five fusion gene transcripts were obtained. These fusion genes contained not only CML-specific BCR-ABL rearrangements, but also other forms of BCR-ABL fusions. These latter genes had junctions of BCR exon 4/ABL exon 2 intervened by a segment of DNA of unknown origin, BCR exon 5/ABL exon 2, and BCR exon 4/ABL exon 2. The results appear to be the first evidence for the induction of the BCR-ABL fusion gene by X-irradiation. In terms of leukemogenesis, it is suggested that only those cells bearing certain CML-related BCR-ABL fusion genes are positively selected by virtue of a growth advantage in vivo. (author).

33938 (INIS-JP–008, pp. 151-154) **Somatic mutation at the TCR loci as a biological dosimeter of radiation-exposed people.** Umeki, Shigeko (Radiation Effects Research Foundation, Hiroshima (Japan)); Kusunoki, Yoichiro; Akiyama, Mitoshi; Endo, Keigo; Ohama, Kozo; Kodama, Takashi; Yamakido, Michio. Japan Atomic Energy Research Inst., Tokyo (Japan). 1992. 558p. (CONF-9203223–: International conference on radiation effects and protection, Mito (Japan), 18-20 Mar 1992). In *Proceedings of the international conference on radiation effects and protection.* Order Number DE93764166. Source: OSTI; NTIS; INIS.

We have recently established a new assay system, the T-cell receptor (TCR) mutation assay, for use as a biological dosimeter of recent radiation exposure. Although there was no obvious dose-dependent increase of the mutant frequency (Mf) at the TCR loci in the lymphocytes from A-bomb survivors, a significant increase of the Mf has been observed in patients who were administered Thorotrast, a radioactive contrast medium, many years ago. These patients have been continuously irradiated with alpha-particles emitted from the deposition of thorium dioxide. Therefore, these results suggested that the TCR mutants had undergone negative selection in vivo in the A-bomb survivors during the 45 years since exposure. To determine whether TCR mutants were actually selected against in vivo, Mfs in 36 uterine cervical cancer patients who had received radiotherapy were investigated, since they have a long survival time after therapy. The TCR Mf among uterine cervical cancer patients decreased exponentially with the passage of time after therapy, and the half-life was calculated to be about 2 years. The Mf in thyroid cancer patients recently treated with ^{131}I increased significantly with increasing ^{131}I dose, taking the half-life of the mutants into consideration. These results suggest that the assay of TCR mutants may be useful as a biological dosimeter for the evaluation of recent radiation exposure. (author).

33939 (INIS-JP–008, pp. 155-159) **Preparation of monoclonal antibodies against radiation-induced protein.** Nozawa, R. (Japan Atomic Energy Research Inst., Takasaki, Gunma (Japan). Takasaki Radiation Chemistry Research Establishment); Tanaka, A.; Watanabe, H.; Kitayama, S. Japan Atomic Energy Research Inst., Tokyo (Japan). 1992. 558p. (CONF-9203223–: International conference on radiation effects and protection, Mito (Japan), 18-20 Mar 1992). In *Proceedings of the international conference on radiation effects and protection.* Order Number DE93764166. Source: OSTI; NTIS; INIS.

We obtained the 6 monoclonal antibodies against gamma-induced proteins of Deinococcus radiodurans, and these antibodies were designated as Mab-3F, 4B, 4D, 4F, 4G and 12G. Using these antibodies, we investigated the relations between gamma-induced proteins and other stress protein in strain R1, and the induction of proteins were compared among strain R1, resistant mutant (rec1)

and radiosensitive mutant (rec30). We found new 6 proteins recognized by these monoclonal antibodies which were induced after gamma-irradiation especially in strain R1 and rec 1, but not induced in strain rec30. We suppose that these proteins participate in repair of DNA damages including double strand breaks caused by gamma-irradiation. One of them was around 46kDa protein band recognized by Mab-12G, and this protein was so induced in a large quantity after irradiation that the protein could detect by gold staining. In addition to this observation, we found some proteins which were induced in R1 and rec 1 by gamma-irradiation and other stress, but not in strain rec30, such as 31kDa protein band recognized by Mab-3F, 4B and 4G, and other 11 proteins which were especially induced in irradiated strain R1. The latter proteins might be reinforcement factor to radioresistance such as GroE and DnaK, or participant in repair of damage by gamma-irradiation in strain R1. (author).

33940 (INIS-JP–008, pp. 160-165) **Characterization of radiation-induced proteins in Deinococcus radiodurans.** Tanaka, A. (Japan Atomic Energy Research Inst., Takasaki, Gunma (Japan). Takasaki Radiation Chemistry Research Establishment); Watanabe, H.; Nozawa, R.; Hu, Q.; Kitayama, S. Japan Atomic Energy Research Inst., Tokyo (Japan). 1992. 558p. (CONF-9203223–: International conference on radiation effects and protection, Mito (Japan), 18-20 Mar 1992). In *Proceedings of the international conference on radiation effects and protection.* Order Number DE93764166. Source: OSTI; NTIS; INIS.

Induction of proteins after gamma-irradiation in Deinococcus radiodurans were investigated. 10 proteins were induced and about 15 proteins were reduced after irradiation with 6kGy. These proteins were classified to four groups by responses to gamma-rays, UV light, mitomycin C(MMC) treatment and heating. Additional studies were carried out for the characterization of two induced proteins. One protein was induced by gamma-rays, UV light as well as heating. This protein appeared to be a glycoprotein from its reaction with lectin. From the amino acid sequences of N-terminal and internal region, it was found that this protein is homologous to EF-Tu protein of E. coli. Meanwhile the other protein was induced not only by gamma-rays but also by UV light and MMC treatment. This protein seems to be a new enzyme as it has no homology to the known proteins which have ever been analyzed. No accumulations of these two proteins were observed in radiation sensitive strain of D. radiodurans and in both of E. coli and Bacillus pumilus, suggesting that induction of these two proteins would be specific for high resistant strain. (author).

33941 (INIS-JP–008, pp. 166-170) **Comparison of radiation-induced proteins in two revertants with those in a radiation sensitive mutant of Deinococcus radiodurans.** Hu Qian (Suzhou Medical Coll., JS (China)); Tanaka, Atsushi; Kobayashi, Yasuhiko; Nozawa, Ranko; Watanabe, Hiroshi. Japan Atomic Energy Research Inst., Tokyo (Japan). 1992. 558p. (CONF-9203223–: International conference on radiation effects and protection, Mito (Japan), 18-20 Mar 1992). In *Proceedings of the international conference on radiation effects and protection.* Order Number DE93764166. Source: OSTI; NTIS; INIS.

In order to search proteins responsible for DNA repair, the intracellular proteins in gamma-irradiated cells of D.radiodurans R1 and its three mutants were analyzed by means of two-dimensional gel electrophoresis. Two new proteins, P35 (M.W. 35 kDa) and P92 (M.W. 92 kDa), were found in the cells of the radioresistant revertant (KH8401-1-5) and D.radiodurans R1. However, only P92 was detected in the moderately radioresistant revertant (KH8401-10-7). Both proteins were not detected in the cells of the radiosensitive mutant (KH8401). On the other hand, one protein, P25 (M.W. 25 kDa), which was detected either before or after gamma-irradiation, was only found in KH8401-10-7. These results suggest that these special induced proteins, P35 and P92, might be directly responsible for radiation resistance. The analyses of similar proteins in the cells of E.coli B/r and Deinobactor grandis KS0460 were also carried out. (author).

33942 (INIS-JP–008, pp. 171-176) **High resistance of fibroblasts from Mongolian gerbil embryos to cell killing and chromosome aberrations by X-irradiation.** Suzuki, F. (Kanazawa Univ. (Japan). Faculty of Pharmaceutical Sciences); Nakao, N.; Nikaido, O.; Kondo, S. Japan Atomic Energy Research Inst., Tokyo (Japan). 1992. 558p. (CONF-9203223–: International conference on radiation effects and protection, Mito (Japan), 18-20 Mar 1992). In *Proceedings of the international conference on radiation effects and protection.* Order Number DE93764166. Source: OSTI; NTIS; INIS.

Mongolian gerbil (Meriones unguiculatus) is known to be one of the most radioresistant animal species. In order to determine whether there is any correlation between mortality of mammals exposed to γ- or X-rays and radiation sensitivity of culture cells derived from different mammalian species, we have examined the X-ray survival curves of normal diploid fibroblasts from Mongolian gerbil embryos and compared with those of other cultured embryo cells from various laboratory animals and normal human. There was a big difference in cell survival to X-rays among different mammalian species. The D_0 values of Mongolian gerbil cells ranged from 2.3 to 2.6 Gy which are twice as high as those of human cells. The mean D_0 value of human cells was 1.1 Gy. Mouse, rat, Chinese hamster and Syrian/golden hamster cells showed similar D_0 values ranging from 1.7 to 2.0 Gy. When cells were irradiated with 2 Gy of X-rays, three times longer mitotic delay was observed in human cells than in Mongolian gerbil cells. At this X-ray dose, furthermore, ten times more chromosome aberrations were detected in human cells than in Mongolian gerbil cells, and the frequencies of other rodent cells lay between the values for the two cell strains. These data indicate that the Mongolian gerbil cells are resistant to X-ray-induced cell killing and chromosome aberrations, and that radiation sensitivity of primarily cultured mammalian cells may be reflected by their radioresistance in vivo. (author).

33943 (INIS-JP–008, pp. 177-180) **Alleviation of acute radiation damages by post-irradiation treatments.** Kurishita, A. (Tohoku Univ., Sendai (Japan). School of Medicine); Ono, T. Japan Atomic Energy Research Inst., Tokyo (Japan). 1992. 558p. (CONF-9203223–: International conference on radiation effects and protection, Mito (Japan), 18-20 Mar 1992). In *Proceedings of the international conference on radiation effects and protection.* Order Number DE93764166. Source: OSTI; NTIS; INIS.

Radiation induced hematopoietic and gastro-intestinal damages in mice were tried to alleviate experimentally by post-treatment. Combined treatment of OK-432 and aztreonam clearly prevented the radiation induced sepsis and elevated the survival rate in mice; the survival was 80% in the OK-432 plus aztreonam group while it was 55% in the group treated with OK-432 alone and 0% with saline. Irsogladine maleate, an anti-ulcer drug, increased the survival rate of jejunal crypt stem cells with a clear dose-related trend. The D_0 for irsogladine maleate was 2.8 Gy although it was 2.3 Gy for saline, These findings suggest that some conventional drugs are effective for radiation induced hematopoietic and gastro-intestinal damages and the possibility that they can be applied for people exposed to radiation accidentally. (author).

33944 (INIS-JP–008, pp. 181-186) **Effects of 5-fluorouracil on survival and hematopoiesis in irradiated mice.** Kojima, E. (National Inst. of Radiological Sciences, Chiba (Japan)); Tsuboi, A. Japan Atomic Energy Research Inst., Tokyo (Japan). 1992. 558p. (CONF-9203223–: International conference on radiation effects and protection, Mito (Japan), 18-20 Mar 1992). In *Proceedings of the international conference on radiation effects and protection.* Order Number DE93764166. Source: OSTI; NTIS; INIS.

The effects of whole-body irradiation on survival and hematopoiesis were studied in mice treated with 5-fluorouracil (5-FU). Animals (ddy-SLC male mice, 8 - 10 weeks old) were injected with 5-FU (i.p.) as a single dose (150 mg/kg) at various times before or after irradiation with X-rays. In mice pretreated with 5-FU at different intervals before X-irradiation (1.9 Gy), the radiosensitivity of the CFU-S population changed day by day after the treatment. The maximal survival for femoral CFU-S was obtained in mice treated with 5-FU at 5 days before irradiation. The post-irradiation recovery for femoral and splenetic CFU-S in mice pretreated with 5-FU at 3 days before X-irradiation (1.9 Gy) was faster than in mice given irradiation alone. The pattern of change for thrombocyte counts in the circulating blood after X-irradiation (1.9 Gy) was greatly modified by the pretreatment with 5-FU at 5 days before

irradiation, being effective in lessening the radiation-induced depression. For survival experiments, treatment of mice with 5-FU at 5 days before X-irradiation with graded doses (4.8 to 7.6 Gy) was the most effective in reducing for radiation lethality. The dose reduction factor was obtained as 1.24. However, treatment with 5-FU at 1 day and 2 hours before, and at times after irradiation increased the radiation lethality compared to the untreated controls. Such phenomena on the decrease or the increase of radiation lethality of 5-FU exhibited a similar pattern to the radiation-dose relation on endogenous and exogenous CFU-S. (author).

33945 (INIS-JP–008, pp. 187-191) **Genetic control of the radiosensitivity of lymphoid cells for antibody-forming ability in CXS series of recombinant inbred mouse strains.** Okumoto, M. (Osaka Prefectural Univ., Sakai (Japan). Research Inst. for Advanced Science and Technology); Mori, N.; Nishikawa, R.; Imai, S.; Hilgers, J.; Takamori, Y.; Yagasaki, O. Japan Atomic Energy Research Inst., Tokyo (Japan). 1992. 558p. (CONF-9203223–: International conference on radiation effects and protection, Mito (Japan), 18-20 Mar 1992). In *Proceedings of the international conference on radiation effects and protection.* Order Number DE93764166. Source: OSTI; NTIS; INIS.

Incidence of radiation-induced lymphomas differs remarkably among various mouse strains. BALB/cHeA (C) mice are highly susceptible to radiation induction of lymphomas, while STS/A (S) mice are resistant. Thus, the induction of the disease is controlled by some genetic factors. To examine an involvement of radiosensitivity of lymphoid cells in lymphomagenesis, we have compared genetic control of the radiosensitivity for antibody-forming ability with that of lymphoma development in BALB/cHeA, STS/A, $(CXS)F_1$ hybrids and CXS series of recombinant inbred strains. Decrease of number of splenic plaque-forming cell (PFC) in Jerne's method by 3 Gy of X-irradiation for BALB/cHeA mice was larger than that for STS/A mice by more than one order of magnitude. $(CXS)F_1$ hybrid mice showed small number of decrease of PFC similar to STS/A mice suggesting that phenotype of radioresistance was dominant over sensitivity. The best concordance between genetic markers and radiosensitivities of antibody-forming ability in recombinant inbred strains was observed in a region containing Igh locus on chromosome 12. The results show that one locus controlling the radioresistance of lymphoid cells for antibody-forming ability might exist in the region containing Igh locus, and that this region clearly differ from a region with Ifa locus on chromosome 4 which regulate the susceptibility to radiation-induced lymphomagenesis. (author).

33946 (INIS-mf–13676, pp. Z9.1-Z9.8) **Natural radionuclide contents of some environmental components as affected by the geological structure of the Pribram region.** Solnicka, H. (Ustav Hygieny Prace v Uranovem Prumyslu, Pribram (Czech Republic)); Kubicek, I.; Merta, J. Ceskoslovensky Uranovy Prumsl, Pribam (Czech Republic). 1992. (In Czech). (CONF-9210351–: The mining town of Pribram in science and technology, Pribram (Czechoslovakia), 12-14 Oct 1992). In *Mining and the environment.* 168p. Order Number DE93633757. Source: OSTI; NTIS (US Sales Only); INIS.

English translation available from Nuclear Information Center, 156 16 Prague-Zbraslav, Czech Republic, at USD 10.- per typewritten page.

Results of natural radioactivity measurements in the Pribram region are presented including particularly radon in building materials, in sands, and in ground water from which the population is supplied. Examples of measurement at various sites are given with the differences depending on the bedrock explained. (M.D.). 5 tabs., 11 refs.

33947 (INIS-RU–350, pp. 85) **Effect of agrochemical and agrometeorological factors on cesium-137 buildup in agricultural plants.** Duginov, V.I.; Olejnik, R.N.; Prister, B.S.; Perepelyatnikova, L.V. AN SSSR, Moscow (Russian Federation). Inst. Geokhimii i Analiticheskoj Khimii. 1990. (In Russian). (CONF-9010541–: 4. Conference of scientific council at the GEOKHI of the USSR Academy of Sciences on the programme AEhS-VO, Gomel' (Belarus), 13 Oct 1990). In *Geochemical ways of artificial radionuclide migration in biosphere: Summaries of reports.* 159p. Order Number DE93633561. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. CESIUM 137/radionuclide migration; PLANTS/contamination; FOOD INDUSTRY; AGRICULTURE; CROPS; CULTIVATION TECHNIQUES; PH VALUE; PLANTS; CONTAMINATION; RESPONSE MODIFYING FACTORS; SOILS; FOOD CHAINS; FOOD PROCESSING

33948 (ORNL/FTR–4345) **Travel to Great Britain and Germany concerning radiation dosimetry research: Foreign trip report, July 7–August 10, 1992.** Turner, J.E. Oak Ridge National Lab., TN (United States). 24 Aug 1992. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93014401. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A study is being coordinated by D. T. Goodhead and H. Nikjoo of the Medical Research Council (MRC) to analyze and compare the characteristics of electron tracks in water as computed independently at four different laboratories. The traveler and his colleagues at Oak Ridge National Laboratory (ORNL) are one of the participating parties. The traveler discussed this work, which until now has been carried out remotely by means of Bitnet, in detail at MRC. Dr. Nikjoo will present results in September at the Eleventh Symposium on Microdosimetry, which ORNL is hosting. At GSF, the traveler continued collaborative work with H. G. Paretzke on general concepts in radiation dosimetry. The research focused on combining track-structure calculations with characterizations of microscopic biological targets.

33949 (ORNL/FTR–4642) **Travel to Austria to attend meeting on effects of atomic radiation: Foreign trip report, May 22–29, 1993.** Selby, P.B. Oak Ridge National Lab., TN (United States). 9 Jun 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93015789. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The traveler attended the forty-second session of UNSCEAR where he took part in the meetings of the Biological Subgroup and the Working Group of the entire UNSCEAR Committee. The traveler made important contributions to the "Report to the General Assembly" and to the long annexes entitled, "Hereditary Effects of Radiation" and "Influence of Dose and Dose Rate on Stochastic Effects of Radiation." All three of these documents received final approval for publication late this year. The traveler has played a major role in the development of the annex on hereditary effects of radiation, and he wrote the 7-page Rapporteur's report recording the most important final changes agreed to for that annex. The new report includes preliminary results from the traveler's large radiation experiments using the Assessment of Dominant Damage approach, and it should set the stage nicely for a major improvement in the direct method of genetic risk estimation when those experiments are complete. The traveler's familiarity with many earlier experiments done at ORNL by himself and others proved to be of importance to the Subgroup during its dicussions.

33950 (ORNL/TM–12224) **Technical basis for nuclear accident dosimetry at the Oak Ridge National Laboratory.** Kerr, G.D.; Mei, G.T. Oak Ridge National Lab., TN (United States). Aug 1993. 51p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93040067. Source: OSTI; NTIS; INIS; GPO Dep.

The Oak Ridge National Laboratory (ORNL) Environmental, Safety, and Health Emergency Response Organization has the responsibility of providing analyses of personnel exposures to neutrons and gamma rays from a nuclear accident. This report presents the technical and philosophical basis for the dose assessment aspects of the nuclear accident dosimetry (NAD) system at ORNL. The issues addressed are regulatory guidelines, ORNL NAD system components and performance, and the interpretation of dosimetric information that would be gathered following a nuclear accident.

33951 (ORNL/TM–12365) **Evaluation of discrepancies between thermoluminescent dosimeter and direct-reading dosimeter results.** Shaw, K.R. Oak Ridge National Lab., TN (United States). Jul 1993. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93017986. Source: OSTI; NTIS; INIS; GPO Dep.

Currently at Oak Ridge National Laboratory (ORNL), the responses of thermoluminescent dosimeters (TLDs) and direct-reading dosimeters (DRDs) are not officially compared or the discrepancies investigated. However, both may soon be required due to the new US Department of Energy (DOE) Radiological Control Manual. In the past, unofficial comparisons of the two dosimeters have led to discrepancies of up to 200%. This work was conducted to determine the reasons behind such discrepancies. For tests conducted with the TLDs, the reported dose was most often lower than the delivered dose, while DRDs most often responded higher than the delivered dose. Trends were identified in personnel DRD readings, and ft was concluded that more training and more control of the DRDs could improve their response. TLD responses have already begun to be improved; a new background subtraction method was implemented in April 1993, and a new dose algorithm is being considered. It was concluded that the DOE Radiological Control Manual requirements are reasonable for identifying discrepancies between dosimeter types, and more stringent administrative limits might even be considered.

33952 (PNL–8749) **PNL-MA-70 QA Plan.** Ethridge, L.J. Pacific Northwest Lab., Richland, WA (United States). 2 Jun 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93018452. Source: OSTI; NTIS; GPO Dep.

The Instrument and External Dosimetry Section provides the calibration service for all portable radiation monitoring measuring and test equipment used on the Hanford Site. This document outlines the quality assurance (QA) plan for the Instrument Calibration and Evaluation Program. The scope of the QA plan in outlined, requirement specifications are provided, and QA program/organization and impact level are discussed.

33953 (PNL-SA–21741) **Direct Ionization of DNA in solution.** Miller, J.H. (Pacific Northwest Lab., Richland, WA (US)); Wilson, W.E.; Ritchie, R.H. Pacific Northwest Lab., Richland, WA (United States). Jul 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-9304185–2: DOE workshop on computational approaches in molecular radiation biology: Monte Carlo methods, Irvine, CA (United States), 26-29 Apr 1993). Order Number DE93019171. Source: OSTI; NTIS; GPO Dep.

Most of the energy absorbed in the cell nucleus from a radiation field goes into the aqueous medium that surrounds macromolecules, like DNA, which are critical to the normal function of cells. This part of the energy deposition produces numerous reactive species that can diffuse to DNA sequences and induce chemical changes. The average diffusion distance of the free radicals that mediate this indirect mode of DNA damage is only a few nanometers because the cellular medium contains a high concentration of molecules that rapidly scavenge the radiation-induced species. Under these conditions, direct interaction of the radiation field with DNA can not be neglected as a potential mode of damage induction. Two aspects of the direct effect are discussed in this paper: (1) screening of the interaction between DNA and charged particles by the dielectric response of the aqueous medium and (2) the impact-parameter dependence of these interactions.

33954 (PNWD–2161-HEDR) **Fuel-element failures in Hanford single-pass reactors 1944–1971.** Gydesen, S.P. Pacific Northwest Lab., Richland, WA (United States). Jul 1993. 357p. Sponsored by Department of Health and Human Services, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93017969. Source: OSTI; NTIS; INIS; GPO Dep.

Hanford Environmental Dose Reconstruction Project.

The primary objective of the Hanford Environmental Dose Reconstruction (HEDR) Project is to estimate the radiation dose that individuals could have received as a result of emissions since 1944 from the US Department of Energy's (DOE) Hanford Site near Richland, Washington. To estimate the doses, the staff of the Source Terms Task use operating information from historical documents to approximate the radioactive emissions. One source of radioactive emissions to the Columbia River came from leaks in the aluminum cladding of the uranium metal fuel elements in single-pass reactors. The purpose of this letter report is to provide photocopies of the documents that recorded these failures. The data from these documents will be used by the Source Terms Task to determine the contribution of single-pass reactor fuel-element failures to the radioactivity of the reactor effluent from 1944 through 1971. Each referenced fuel-element failure occurring in the Hanford single-pass reactors is addressed. The first recorded failure was in 1948, the last in 1970. No records of fuel-element failures were found in documents prior to 1948. Data on the approximately 2000 failures which occurred during the 28 years (1944–1971) of Hanford single-pass reactor operations are provided in this report.

33955 (RISO-HOT-DECOM-P–5) **Decommissioning of the Risoe Hot Cell facility: 5. Periodic report covering July 1 to December 31, 1992.** Carlsen, H. Risoe National Lab., Roskilde (Denmark). Materials Dept. Feb 1993. 7p. Contract FI2D-0011-DK. Order Number DE94600192. Source: OSTI; NTIS; INIS.

A concise description of the current status (December 31st, 1992) regarding the decommissioning of the hot cell facility at Risoe National Laboratory is given in this periodic report. During the second half of the year 1992, all remaining fissile material and a large amount of contaminated material were removed, major repair work was carried out on the in-cell crane, the shielded storage facility was decontaminated and sealed, iodine filters in the cell ventilation system were removed, remote cleaning was carried out on three concrete cells to radiation levels acceptable for final cleaning by frogmen, and the remaining work schedule was planned. These processes are briefly described. Some breakdowns of older, but vital equipment (i.e. the in-cell crane and the power manipulator) that was taken into extensive use led to a certain amount of delay. The collective radiation doses during this half-year were no higher than under normal operation of the facility, and amounted to 12 man-mSv ascribed to 14 persons. It was concluded that, when removing old epoxy paint in the cells using paint strippers applied by hand, personnel can wear polythene oversuits, although a technique for remote handling has been developed. Tables illustrate measured radiation levels in cells number 1,4,5 and 6, and a diagram describes the shielded storage facility. (AB).

33956 (SAND–93-0761C) **Dissolution rate and radiation dosimetry of metal tritides.** Jow, Hong-Nian (Sandia National Labs., Albuquerque, NM (United States)); Cheng, Yung-Sung. Sandia National Labs., Albuquerque, NM (United States); Inhalation Toxicology Research Inst., Albuquerque, NM (United States). [1993]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789 ;AC04-76EV01013. (CONF-9303187–1: DOE radiation protection workshop; Asia and Pacific Basin Regional Congress on radiation protection, Las Vegas, NV (United States); Beijing (China), Mar 1993; 18-22 oct 1993; CONF-9310101–1). Order Number DE93015023. Source: OSTI; NTIS; INIS; GPO Dep.

Metal tritides including titanium tritide (Ti^3H_x) and erbium tritide (Er^3H_x) have been used as components of neutron generators. These compounds can be released to the air as aerosols during fabrication, assembling and testing of components or in accidental or fugitive releases. As a result, workers could be exposed to these compounds by inhalation. A joint research project between SNL and ITRI (Inhalation Toxicology Research Institute) was initiated last fall to investigate the solubility of metal tritides, retention and translocation of inhaled particles and internal dosimetry of metal tritides. The current understanding of metal tritides and their radiation dosimetry for internal exposure are very limited. There is no provision in the ICRP-30 for tritium dosimetry in metal tritide form. However, a few papers in the literature suggested that the solubility of metal tritide could be low. The current radiation protection guidelines for metal tritide particles are based on the assumption that the biological behavior is similar to tritiated water which behaves like body fluid with a relative short biological half life (10 days). If the solubility of metal tritide is low, the biological half life of metal tritide particles and the dosimetry of inhalation exposure to these particles could be quite different from tritiated water. This would have major implications in current radiation protection guidelines for metal tritides Including annual limits of intakes and derived air concentrations. The preliminary results of metal tritide dissolution study at ITRI indicate that the solubility of titanium tritide is low. The outlines of the project, the preliminary results and future work will be discussed in presentation.

33957 (SIS–1993:2) **Individual measurements of external radiation doses from Chernobyl fallout in Oeystre Slidre.** Woehni, T.; Selnaes, T.; Strand, P. Statens Straalevern, Oesteraas (Norway). 1993. 22p. (In Norwegian). Order Number DE94600194. Source: OSTI; NTIS; INIS.

External doses from Chernobyl fallout have in previous reports primarily been estimated on the basis of theoretical calculations based on measurements of ground activity. The uncertainty in these estimations are large, partly due to limited data regarding the fallout pattern, and partly because the conversion factors from total ground activity to effective doses depend on the activity depth-distribution in soil. In the present project, measurements of external doses have been performed with the aid of individual dosemeters. Oeystre Slidre was the single municipality receiving the highest fall-out levels after the Chernobyl accident, and thus the area best suited for detecting the increase in external radiation levels by this method. The measurements show that the increase in external radiation levels after the Chernobyl accident is clearly detectable, at least in areas with the highest activity levels. However, even in this areas natural background radiation constitute the largest component to the total dose from external radiation, namely 60 to 70%. 20 refs., 3 figs., 4 tabs.

33958 (SIS–1993:3) **Calibration of the Norwegian standards for measuring ionizing radiation in radiotherapy.** Bjerke, H.; Unheim, J.F. Statens Straalevern, Oesteraas (Norway). 1993. 21p. (In Norwegian). Order Number DE94600195. Source: OSTI; NTIS; INIS.

As part of calibration on a regulary basis, the Norwegian secondary standards on ionizing radiation were calibrated at the Bureau International des Poids et Mesures (BIPM) in Paris in 1991. The secondary standards set up the basis for the calibration service at the Norwegian Radiation Protection Authority. The X-ray range from 10 to 50 kV and 100 to 250 kV is covered, as well as γ-radiation from ^{60}Co (1.25 MeV). A new ionization chamber was calibrated in the ^{60}Co radiation beam in addition to calibration of existing secondary standards. Furthermore, two of the ionization chambers were also calibrated in water in the ^{60}Co radiation beam. This makes it possible to offer the radiotherapy centers in Norway a calibration factor based on calibration in water. 8 refs., 7 figs., 7 tabs.

33959 (WHC-SA–1826) **1991 implementation of As Low As Reasonably Achievable (ALARA) administrative radiation exposure levels: Experiences and lessons learned.** Aldridge, T.L.; Baumann, B.L. Westinghouse Hanford Co., Richland, WA (United States). Jun 1993. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-87RL10930. (CONF-930746–1: Annual meeting of the Health Physics Society, Atlanta, GA (United States), 11-15 Jul 1993). Order Number DE93019120. Source: OSTI; NTIS; INIS; GPO Dep.

As Low As Reasonably Achievable (ALARA) radiation exposure levels were implemented on January 1, 1991, by Westinghouse Hanford Company (WHC), a prime US Department of Energy (DOE) contractor, located in Richland, Washington. This paper describes the radiation exposure levels which were implemented and the associated experiences and lessons learned. The issue of a report from the Committee on Biological Effectiveness of Ionizing Radiation in 1989 prompted DOE to re-evaluate its position on radiation exposure limits and the resulting doses received by occupational radiation workers. DOE requested that all it's contractors determine the impacts to operations from reduced radiation exposure levels.

5603 Chemicals Metabolism and Toxicology

Refer also to citation(s) 32249, 32554, 32570, 33772, 33851, 33852, 33910, 34702

33960 (ANL/ESH/CP–80561) **Industrial hygiene of selected heavy metals.** Woodring, J.L. Argonne National Lab., IL (United States). [1993]. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930802–12: 206. American Chemical Society national meeting, Chicago, IL (United States), 22-27 Aug 1993). Order Number DE93019558. Source: OSTI; NTIS; INIS; GPO Dep.

The industrial hygiene of heavy metals consists of recognition, evaluation, and control of exposures in the occupational environment. Several of these metals have been in use since ancient times. Reports of health effects and poisonings from overexposures also have a long history. This report discusses the industrial hygiene of the heavy metals, lead, cadmium, mercury, and manganese.

33961 (DOE/ER/61029–14) **The hygroscopicity of indoor aerosol particles.** Wei, L. Clarkson Univ., Potsdam, NY (United States). Dept. of Chemistry. Jul 1993. 159p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-90ER61029. Order Number DE93040689. Source: OSTI; NTIS; INIS; GPO Dep.

A system to study the hygroscopic growth of particle was developed by combining a Tandem Differential Mobility Analyzer (TDMA) with a wetted wall reactor. This system is capable of mimicking the conditions in human respiratory tract, and measuring the particle size change due to the hygroscopic growth. The performance of the system was tested with three kinds of particles of known composition, NaCl, $(NH_4)_2SO_4$, and $(NH_4)HS0_4$ particles. The hygroscopicity of a variety of common indoor aerosol particles was studied including combustion aerosols (cigarette smoking, cooking, incenses and candles) and consumer spray products such as glass cleaner, general purpose cleaner, hair spray, furniture polish spray, disinfectant, and insect killer. Experiments indicate that most of the indoor aerosols show some hygroscopic growth and only a few materials do not. The magnitude of hygroscopic growth ranges from 20% to 300% depending on the particle size and fraction of water soluble components.

33962 (LA–12539-MS) **Kinetics programs for simulation of tropospheric photochemistry on the global scale.** Elliott, S. (Los Alamos National Lab., NM (US)); Kao, C.Y.J.; Turco, R.P.; Zhao, X.P. Los Alamos National Lab., NM (United States). Aug 1993. 55p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93019035. Source: OSTI; NTIS; INIS; GPO Dep.

The study of tropospheric kinetics underlies global change because key greenhouse gases are photochemically active. Modeling of tropospheric chemistry on a global scale is essential because some indirect greenhouse gases are short-lived and interact in a non-linear fashion. It is also extremely challenging, however; the global change grid is extensive in both the physical and temporal domains, and critical lower atmospheric species include the organics and their oxidized derivatives, which are numerous. Several types of optimization may be incorporated into kinetics modules to enhance their ability to simulate the complete lower atmospheric gas phase chemical system. (1) The photochemical integrator can be accelerated by avoiding matrix and iterative solutions and by establishing families. Accuracy and mass conservation are sacrificed in the absence of iteration, but atom balancing is restorable post hoc. (2) Chemistry can be arranged upon the massive grid to exploit parallel processing, and solutions to its continuity equations can be automated to permit experimentation with species and reaction lists or family definitions. Costs in programming effort will be incurred in these cases. (3) Complex hydrocarbon decay sequences can be streamlined either through structural lumping methods descended from smog investigations, which require considerable calibration, or by defining surrogates for classes of compounds, with a loss in constituent detail. From among the available options, the most advantageous permutations will vary with the specific nature of any eventual global scale study, and there is likely to be demand for many approaches. Tracer transport codes serve as a foundation upon which tropospheric chemistry packages will be tested. Encroachment of the NO_x sphere of influence upon tropical rain forests and the upper free troposphere are two examples of specific problems to which full three-dimensional chemical simulations might be applied.

33963 (LA–12615-MS) **Acute and chronic sulfur dioxide fumigation of Piñon pine seeds and seedlings: Data compilation.** Trujillo, M.L. (Los Alamos National Lab., NM (United States)); Ferenbaugh, R.W.; Gladney, E.S.; Bowker, R.G. Los Alamos National Lab., NM (United States). Sep 1993. 34p. Sponsored by

Department of the Interior, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93019359. Source: OSTI; NTIS; GPO Dep.

Piñon pine germinating seeds, emergent seedlings, and one-year-old seedlings were exposed to sulfur dioxide under both acute and chronic exposure conditions. These fumigations were conducted in order to determine the potential for damage to piñon pine in southwestern national parks and monuments where there is potential for exposure to elevated sulfur dioxide concentrations from smelters and power plants. Injury was apparent only in acute fumigations of one-year-old seedlings at ambient sulfur dioxide concentrations of greater than 3 ppm. Chronic fumigations were conducted only a ambient concentrations of 0.2 ppm. Piñon pine resistance was evidenced by lack of effect of fumigation on biomass and growth parameters. Growth rate data for both experimental and control seedlings were fit to a linear growth model with a correlation (r^2 = 0.95). The results of this study agree with other data in the literature and indicate that damage from elevated sulfur dioxide concentrations in southwestern national parks and monuments is much more likely for other, more sensitive, species than for piñon pine.

33964 (ORNL/FTR–4627) **Travel to ORNL for meeting on Protection Against Environmental Mutagens and Carcinogens (ICPEMC): Foreign trip report, May 9–23, 1993.** Favor, J.B. (Institut fuer Saugetiergenetik, GSF-Forschungszentrum fuer Umwelt und Gesundheit, D-8042 Neuherberg, (Germany)). Oak Ridge National Lab., TN (United States). 26 May 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93015638. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The traveler attended the fourth meeting of a special work group of the International Commission for the Protection Against Environmental Mutagens and Carcinogens (ICPEMC) held May 10–12, 1993, at the Oak Ridge National Laboratory. This special ICPEMC work group was convened in cooperation with ICPEMC and the Biomedical and Environmental Information Analysis Section of the Health and Safety Research Division by request of The US Environmental Protection Agency (EPA). The work group is charged with the preparation of a document for on extrapolation methods for genetic toxicology risk assessment. The draft of this document, prepared during previous meetings, was reviewed for eventual submission to EPA in June 1993.

5604 Other Environmental Pollutant Effects

Refer also to citation(s) 32998, 33912

33965 (ETDE-IT–93-208) **Biological effects from electromagnetic fields: Research progress and exposure measurements.** Mauro, F. (ENEA, Casaccia (Italy). Area Energia Ambiente e Salute); Lovisolo, G.A.; Raganella, L. 1992. 6p. (In Italian). Order Number DE93522967. Source: OSTI; NTIS (US Sales Only); INIS.

Although it is commonly accepted that exposure to high levels of electromagnetic, micro- and radiofrequency waves produces harmful effects to the health of man, the formulation of exposure limits is still an open process and dependent upon the evolving level of knowledge in this field. This paper surveys the current level of knowledge gained through 'in vitro' and 'in vivo' radiological and epidemiological studies on different types of electromagnetic radiation derived effects - chromosomal, mutagenic, carcinogenic. It then reviews efforts by international organizations, e. g., the International Radiation Protection Association, to establish exposure limits for radiofrequency electromagnetic fields. Brief notes are given on the electromagnetic radiation monitoring campaign being performed by public health authorities in the Lazio Region of Italy.

33966 (UCRL-JC–112318) **The use of dimorphic Alu insertions in human DNA fingerprinting.** Novick, G.E. (Florida International Univ., Miami, FL (United States). Dept. of Biological Sciences); Gonzalez, T.; Garrison, J.; Novick, C.C.; Herrera, R.J.; Batzer, M.A.; Deininger, P.L. Lawrence Livermore National Lab., CA (United States). 4 Dec 1992. 17p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9211249–1: 2. international symposium on DNA fingerprinting, Belo Horizonte (Brazil), 9 Nov 1992). Order Number DE93016530. Source: OSTI; NTIS; GPO Dep.

We have characterized certain Human Specific Alu Insertions as either dimorphic (TPA25, PV92, APO), sightly dimorphic (C2N4 and C4N4) or monomorphic (C3N1, C4N6, C4N2, C4N5, C4N8), based on studies of Caucasian, Asian, American Black and African Black populations. Our approach is based upon: (1) PCR amplification using primers directed to the sequences that flank the site of insertion of the different Alu elements studied; (2) gel electrophoresis and scoring according to the presence or absence of an Alu insertion in one or both homologous chromosomes; (3) allelic frequencies calculated and compared according to Hardy-Weinberg equilibrium. Our DNA fingerprinting procedure using PCR amplification of dimorphic Human Specific Alu insertions, is stable enough to be used not only as a tool for genetic mapping but also to characterize populations, study migrational patterns and track the inheritance of human genetic disorders.

57 HEALTH AND SAFETY

Refer also to citation(s) 32540, 32554, 32557, 33290, 33960

33967 (PNL–8613-Pt.1) **Construction safety in DOE: Part 1, Students guide.** Handwerk, E.C. Pacific Northwest Lab., Richland, WA (United States). [1993]. 550p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019172. Source: OSTI; NTIS; GPO Dep.

This report is the first part of a compilation of safety standards for construction activities on DOE facilities. This report covers the following areas: general safety and health provisions; occupational health and environmental control/haz mat; personal protective equipment; fire protection and prevention; signs, signals, and barricades; materials handling, storage, use, and disposal; hand and power tools; welding and cutting; electrical; and scaffolding.

33968 (PNL–8613-Pt.2) **Construction safety in DOE: Part 2, Students guide.** Handwerk, E.C. Pacific Northwest Lab., Richland, WA (United States). [1993]. 250p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019115. Source: OSTI; NTIS; GPO Dep.

This report is the second part of a compilation of safety standards for construction activities on DOE facilities. This report covers the following areas: floor and wall openings; cranes, derricks, hoists, elevators, and conveyors; motor vehicles, mechanized equipment, and marine operations; excavations; concrete and masonry construction; steel erection; underground construction, caisson, cofferdams, and compressed air; demolition; blasting and the use of explosives; power transmission and distribution; rollover protective structures, overhead protection; and ladders.

5701 Real Accidents

Refer also to citation(s) 32341, 32775, 32776, 33812, 33813, 33915, 33957

58 GEOSCIENCES

Refer also to citation(s) 32252, 32261, 32266, 32310, 32315, 32316, 32375, 32391, 32427, 32461, 32553, 32556, 32579, 32819, 32932, 32966, 32967, 33336, 33348, 33460, 33698, 33721, 33771, 33790, 33816, 33818, 33823, 33834, 33850, 34006, 34653, 34654

33969 (ANL/ESD/TM–49) **Videographic GIS database documentation project for Ft. Knox, Kentucky: Planning and process.** Sullivan, R.G.; Vogt, M.C. Argonne National Lab., IL (United States). Jun 1992. 32p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93019055. Source: OSTI; NTIS; GPO Dep.

The Geographic Resource Analysis Support System (GRASS), a geographic information system (GIS), has been fielded at approximately 50 US Army training installations as a land-management

decision-making tool. Use of the GRASS GIS requires the compilation of numerous digital maps of environmental parameters, including elevation, soils, and hydrography. One of the uses of the GRASS GIS is to create digital graphic images that portray geographic data. A recently emerging technology called computer videographics can be used to graphically enhance GRASS-generated images, thereby creating new ways to visualize GRASS analysis results. Furthermore, videographic tools can be used to convert GRASS images into standard graphic file formats that can be displayed on low-cost personal computers, using inexpensive application software to view the images. The pilot project described in this report demonstrated the capability of videographic tools to enhance GRASS imagery through improved graphic visualization (including three-dimensional visualization) and enhanced labeling. The project also developed self-running demonstrations of GRASS imagery from Ft. Knox, Kentucky, on DOS- and Macintosh-compatible diskettes, using low-cost slide-show software to display the images.

33970 (BNL–49194) **Overview of physical oceanographic measurements taken during the Mt. Mitchell Cruise to the ROPME Sea Area.** Reynolds, R.M. Brookhaven National Lab., Upton, NY (United States). 31 Mar 1993. 61p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. (CONF-9301123–1: 1. scientific workshop on results of the R/V Mt. Mitchell cruise, Kuwait City (Kuwait), 24-28 Jan 1993). Order Number DE93018460. Source: OSTI; NTIS; INIS; GPO Dep.

The ROPME Sea Area (RSA) is one of the most important commercial waterways in the world. However, the number of direct oceanographic observations is small. An international program to study the effect of the Iraqi oil spill on the environment was sponsored by the ROPME, the Intergovernmental Oceanographic Commission, and the National Oceanic and Atmospheric Administration (NOAA).

33971 (DOE/ER/14153–3) **Reactive fluid flow models and applications to diagenesis, mineral deposits and crustal rocks.** Lasaga, A.C.; Rye, D.M. Yale Univ., New Haven, CT (United States). [1993]. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-90ER14153. Order Number DE93019587. Source: OSTI; NTIS; GPO Dep.

Funds are requested for a combined theoretical and field study of coupled fluid flow, heat and mass transport, and chemical reaction in hydrothermal and metamorphic systems. An existing computer code developed by the applicants which numerically treats multi-component, finite-rate reactions combined with advective and dispersive transport in one and two dimensions and which incorporates isotopic exchange and heat and mass transfer will continue to be developed and applied in a variety of geological settings. The code we have developed simultaneously solves for mass transport and reaction, thus offering a significant improvement in computational efficiency over existing "batch" reaction path codes. By coupling flow and chemical reaction in a hydrothermal system, we can explicitly investigate the extent to which characteristic flow-reaction paths govern the chemical evolution of the fluids in a hydrothermal system. The concept of a flow-reaction path is particularly important where certain portions of mature hydrothermal systems may exhaust the buffer capacity of the rock as the primary mineralogy is consumed. In these instances 7 fluids traversing distinct regions within the hydrothermal system may experience very different reaction histories, even where the system can be described as nearly isothermal. The study of paleo-hydrothermal systems can yield some important insights into the chemical dynamics of hydrothermal systems in general. As an example of a paleo-hydrothermal system, we have considered the geochemical evolution of "porphyry-copper" type mineralization.

33972 (DOE/FTR–93016211) **Program for climate model diagnosis and intercomparison: Foreign trip report, April 28, 1993–May 14, 1993.** Grotch, S.L. Lawrence Livermore National Lab., CA (United States). 10 Jun 1993. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93016211. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The traveller spent time in the United Kingdom, Germany, and Italy. In Bracknell, U.K., the traveller explored the possibilities of obtaining observational data from the Hadley Centre for model validation studies at PCMDI. Presented a lecture, "The Use of Distributional Statistics in Model/Data Intercomparisons," on personal research and PCMDI's general studies on the intercomparison of observational and model data. The traveller had technical discussions on the Hadley Centre's current work with GCM's and in model verification. In Reading, U.K., the traveller explored the possibilities of obtaining observational data from the ECMWF for model validation studies at PCMDI. Presented a lecture, April 30th, "Some Non-Traditional Statistical Techniques for Model Intercomparisons," on personal research, and PCMDI's general studies on the intercomparison of observational and model data. Had technical discussions on European Centre's current work with GCM's and in model verification. In Wiesbaden, Germany, the traveler attended conference of the European Geophysical Society and presented a paper: "Statistical Intercomparison of Global Precipitation Data Sets." Explored with other attendees the availability of observational data for PCMDI's purposes. In Bologna, Italy, the traveller attended AMIP/FANGIO joint meeting. Served as chairman for one session. Participated in a panel discussion outlining PCMDI's validation data archive and discussed procedures for obtaining data. Explored with other attendees the availability of new observational data for PCMDI's purposes.

33973 (DOE/RW/00214–T2) **[Geotechnical Board activities and funding]: [Annual] activites report, July 1, 1992–June 30, 1993.** Smeallie, P.H. National Academy of Sciences - National Research Council, Washington, DC (United States). 23 Jul 1993. 69p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG01-90RW00214. Order Number DE93019208. Source: OSTI; NTIS; GPO Dep.

The Geotechnical Board, a part of the US National Research Council, which is the operating arm of the National Academy of Sciences and the National Academy of Engineering, serves to advise the federal government and others on issues where geotechnology can have an impact, such as environmental remediation and infrastructure development. The board met three times during the reporting period to review current projects and to initiate activities that move the knowledge base of geotechnology forward. The board operates with two long-standing national committees, the US National Committee for Rock Mechanics and the US National Committee on Tunneling Technology. It also conducts special studies at the request of the government. A list of attachments is given.

33974 (EGG-NPR–10691-App.1-3) **Analysis of geodetic leveling data in the vicinity of the Idaho National Engineering Laboratory: Main report, Appendices 1–3.** Pelton, J.R. (Boise State Univ., ID (United States). Center for Geophysical Investigation of the Shallow Subsurface). EG and G Idaho, Inc., Idaho Falls, ID (United States); Boise State Univ., ID (United States). Center for Geophysical Investigation of the Shallow Subsurface. Sep 1991. 120p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93019051. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Analysis of geodetic leveling data for 19 lines (6 first-order, 13 second-order) observed between 1906 and 1983 by the national geodetic survey (NGS) in the vicinity of the Idaho National Engineering Laboratory (INEL) are presented. A list of the geodetic leveling instructions issued by the NGS is given. Systematic errors are discussed to include: Rod-temperature error, residual rod-scale error, refraction error, level-collimation error, tidal error, and magnetic error. Statistical models of random error are reviewed, The sum of forward and backward discrepancies and circuit closures are analyzed. A discussion of errors in individual lines is given. Crustal movements from Idaho Falls to Humphrey, Idaho Falls to Pocatello, Chilly to Arco, Arco to Blackfoot, and Howe to Picabo are documented. The first three appendices are included and contain : Rod construction, scribing, graduation, and calibration; residual rod-scale error; and cumulative sum of forward and backward discrepancies. The fourth appendix is found in three separate volumes.

33975 (EGG-NPR–10691-App.4-Pt.1) **Analysis of geodetic leveling data in the vicinity of the Idaho National Engineering Laboratory: Appendix 4, Part 1.** Pelton, J.R. (Boise State Univ., ID (United States). Center for Geophysical Investigation of the

Shallow Subsurface). EG and G Idaho, Inc., Idaho Falls, ID (United States); Boise State Univ., ID (United States). Center for Geophysical Investigation of the Shallow Subsurface. Sep 1991. 152p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93019052. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Analysis of geodetic leveling data for 19 lines (6 first-order, 13 second-order) observed between 1906 and 1983 by the National Geodetic Survey (NGS) in the vicinity of the Idaho National Engineering Laboratory (INEL) is presented. This appendix contains REDUC4 output for Pocatello to Butte, Dubois to Picabo, Chilly to Blackfoot, Chilly to Arco, Terreton to Roberts, and various locations around Blackfoot.

33976 (EGG-NPR–10691-App.4-Pt.2) **Analysis of geodetic leveling data in the vicinity of the Idaho National Engineering Laboratory: Appendix 4, Part 2: L16994, L17006, L17009, L17015, L17481, L17720, L18004.** Pelton, J.R. (Boise State Univ., ID (United States). Center for Geophysical Investigation of the Shallow Subsurface). EG and G Idaho, Inc., Idaho Falls, ID (United States); Boise State Univ., ID (United States). Center for Geophysical Investigation of the Shallow Subsurface. 23 Sep 1991. 158p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93019053. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Analysis of geodetic leveling data for 19 lines (6 first-order, 13 second-order) observed between 1906 and 1983 by the National Geodetic Survey (NGS) in the vicinity of the Idaho National Engineering Laboratory (INEL) are presented. This appendix contains the REDUC4 output for the seven individual lines: L16994, L17006, L17009, L17015, L17481, L17720, and L18004.

33977 (EGG-NPR–10691-App.4-Pt.3) **Analysis of geodetic leveling data in the vicinity of the Idaho National Engineering Laboratory: Appendix 4, Part 3: L21136, L21145, L24756.** Pelton, J.R. (Boise State Univ., ID (United States). Center for Geophysical Investigation of the Shallow Subsurface). EG and G Idaho, Inc., Idaho Falls, ID (United States); Boise State Univ., ID (United States). Center for Geophysical Investigation of the Shallow Subsurface. 23 Sep 1991. 121p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93019054. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Analysis of geodetic leveling data for 19 lines (6 first-order, 13 second-order) observed between 1906 and 1983 by the National Geodetic Survey (NGS) in the vicinity of Idaho National Engineering Laboratory are presented. REDUC4 output for the individual lines: L21136, L21145, and L24756 are given.

33978 (JAB–10733-TM7) **Processed seismic motion records from Desert Hot Springs, California earthquake of April 22, 1992, recorded at seismic stations in southern Nevada.** Lum, P.K.; Honda, K.K. URS/John A. Blume and Associates, Engineers, San Francisco, CA (United States). Apr 1993. 196p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-89NV10733. Order Number DE93018071. Source: OSTI; NTIS; GPO Dep.

For complete package including technical report and 8mm data file, Order no. DE93018072.

As part of the contract with the US Department of Energy, Nevada Field Office (DOE/NV), URS/John A. Blume & Associates, Engineers (URS/Blume) maintains a network of seismographs in southern Nevada to monitor the ground motion generated by the underground nuclear explosions (UNEs) at the Nevada Test Site (NTS). The seismographs are located in the communities surrounding the NTS and the Las Vegas valley. When these seismographs are not used for monitoring the UNE generated nations, a limited number of seismographs are maintained for monitoring motion generated by other than UNEs (e.g. motion generated by earthquakes, wind, blast). During the subject earthquake of April 22nd 1992, a total of 19 of these systems recorded the earthquake motions. This report contains the recorded data.

33979 (JAB–10733-TM8) **Processed seismic motion records from Little Skull Mountain, Nevada earthquake aftershocks of July 5, 1992 and September 13, 1992, recorded at seismic stations in southern Nevada.** Lum, P.K.; Honda, K.K. URS/John A. Blume and Associates, Engineers, San Francisco, CA (United States). Apr 1993. 187p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-89NV10733. Order Number DE93018073. Source: OSTI; NTIS; GPO Dep.

For complete package including technical report and 8mm data file order DE93018074.

As part of the contract with the US Department of Energy, Nevada Field Office (DOE/NV), URS/John A. Blume & Associates, Engineers (URS/Blume) maintains a network of seismographs in southern Nevada to monitor the ground motion generated by the underground nuclear explosions (UNEs) at the Nevada Test Site (NTS). The seismographs are located in the communities surrounding the NTS and the Las Vegas valley. When these seismographs are not used for monitoring the UNE generated motions, a limited number of seismographs are maintained for monitoring motion generated by other than UNEs (e.g. motion generated by earthquakes, wind, blast). During the subject earthquake aftershocks of July 5 and September 13, 1992, a total of 20 of these systems recorded the earthquake motions. This report contains the recorded data.

33980 (JAB–10733-TM9) **Processed seismic motion records from Landers, California earthquake of June 28, 1992, recorded at seismograph stations in southern Nevada.** Lum, P.K.; Honda, K.K. URS/John A. Blume and Associates, Engineers, San Francisco, CA (United States). Apr 1993. 188p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-89NV10733. Order Number DE93018075. Source: OSTI; NTIS; GPO Dep.

For complete package including technical report and 8mm data file, Order no. DE93018076.

As part of the contract with the US Department of Energy, Nevada Field office (DOE/NV), URS/John A. Blume & Associates, Engineers (URS/Blume) maintains a network of seismographs in southern Nevada to monitor the ground motion generated by the underground nuclear explosions (UNEs) at the Nevada Test Site (NTS). The seismographs are located in the communities surrounding the NTS and the Las Vegas valley. When these seismographs are not used for monitoring the UNE generated motions, a limited number of seismographs are maintained for monitoring motion generated by other than UNEs (e.g. motion generated by earthquakes, wind, blast). During the subject earthquake of June 28, 1992, a total of 19 of these systems recorded the earthquake motions. This report contains the recorded data.

33981 (JAB–10733-TM10) **Processed seismic motion records from Big Bear, California earthquake of June 28, 1992, recorded at seismograph stations in southern Nevada.** Lum, P.K.; Honda, K.K. URS/John A. Blume and Associates, Engineers, San Francisco, CA (United States). Apr 1993. 140p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-89NV10733. Order Number DE93018077. Source: OSTI; NTIS; GPO Dep.

For complete package including technical report and 8mm data file, order no. DE93018078.

As part of the contract with the US Department of Energy, Nevada Field office (DOE/NV), URS/John A. Blume & Associates, Engineers (URS/Blume) maintains a network of seismographs in southern Nevada to monitor the ground motion generated by the underground nuclear explosions (UNEs) at the Nevada Test Site (NTS). The seismographs are located in the communities surrounding the NTS and the Las Vegas valley. When these seismographs are not used for monitoring the UNE generated motions, a limited number of seismographs are maintained for monitoring motion generated by other than UNEs (e.g. motion generated by earthquakes, wind, blast). During the subject earthquake of June 28, 1992, a total of 15 of these systems recorded the earthquake motions. This report contains the recorded data.

33982 (JAB–10733-TM11) **Processed seismic motion records from St. George, Utah earthquake of September 2, 1992, recorded at seismic stations in southern Nevada.** Lum, P.K.; Honda, K.K. URS/John A. Blume and Associates, Engineers, San Francisco, CA (United States). Apr 1993. 166p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC08-89NV10733. Order Number DE93018079. Source: OSTI; NTIS; GPO Dep.

For complete package including technical report and 8mm data file order DE93018080.

As part of the contract with the US Department of Energy, Nevada Field Office (DOE/NV), URS/John A. Blume & Associates, Engineers (URS/Blume) maintains a network of seismographs in southern Nevada to monitor the ground motion generated by the underground nuclear explosions (UNEs) at the Nevada Test Site (NTS). The seismographs are located in the communities surrounding the NTS and the Las Vegas valley. When these seismographs are not used for monitoring the UNE generated motions, a limited number of seismographs are maintained for monitoring motion generated by other than UNEs (e.g. motion generated by earthquakes, wind, blast). During the subject earthquake of September 2, 1992, a total of 16 of these systems recorded the earthquake motions. This report contains the recorded data.

33983 (LBL-PUB–728) **DOE workshop: Sedimentary systems, aqueous and organic geochemistry.** Lawrence Berkeley Lab., CA (United States). Jul 1993. 172p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9307107–: DOE workshop: sedimentary systems, aqueous and organic geochemistry, Berkeley, CA (United States), 15-16 Jul 1993). Order Number DE93018532. Source: OSTI; NTIS; INIS; GPO Dep.

A DOE workshop on sedimentary systems, aqueous and organic geochemistry was held July 15-16, 1993 at Lawrence Berkeley Laboratory. Papers were organized into several sections: Fundamental Properties, containing papers on the thermodynamics of brines, minerals and aqueous electrolyte solutions; Geochemical Transport, covering 3-D imaging of drill core samples, hydrothermal geochemistry, chemical interactions in hydrocarbon reservoirs, fluid flow model application, among others; Rock-Water Interactions, with presentations on stable isotope systematics of fluid/rock interaction, fluid flow and petotectonic evolution, grain boundary transport, sulfur incorporation, tracers in geologic reservoirs, geothermal controls on oil-reservoir evolution, and mineral hydrolysis kinetics; Organic Geochemistry covered new methods for constraining time of hydrocarbon migration, kinetic models of petroleum formation, mudstones in burial diagenesis, compound-specific carbon isotope analysis of petroleums, stability of natural gas, sulfur in sedimentary organic matter, organic geochemistry of deep ocean sediments, direct speciation of metal by optical spectroscopies; and lastly, Sedimentary Systems, covering sequence stratigraphy, seismic reflectors and diagenetic changes in carbonates, geochemistry and origin of regional dolomites, and evidence of large comet or asteroid impacts at extinction boundaries.

33984 (SAND–93-0256) **Event triggered data acquisition in the Rock Mechanics Laboratory.** Hardy, R.D. Sandia National Labs., Albuquerque, NM (United States). Mar 1993. 120p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018686. Source: OSTI; NTIS; GPO Dep.

Increasing complexity of experiments coupled with limitations of the previously used computers required improvements in both hardware and software in the Rock Mechanics Laboratories. Increasing numbers of input channels and the need for better graphics could no longer be supplied by DATAVG, an existing software package for data acquisition and display written by D. J. Holcomb in 1983. After researching the market and trying several alternatives, no commercial program was found which met our needs. The previous version of DATAVG had the basic features needed but was tied to obsolete hardware. Memory limitations on the previously used PDP-11 made it impractical to upgrade the software further. With the advances in IBM compatible computers it is now desirable to use them as data recording platforms. With this information in mind, it was decided to write a new version of DATAVG which would take advantage of newer hardware. The new version had to support multiple graphic display windows and increased channel counts. It also had to be easier to use.

33985 (UCRL-ID–113516) **Protocol for computation of surface boundary layer parameters used to determine soil moisture flux from meteorological data collected at LLNL, 1992–93.** Gouveia, F. Lawrence Livermore National Lab., CA (United States). Mar 1993. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93018906. Source: OSTI; NTIS; GPO Dep.

Starting May 1992, meteorological data is continuously collected for Environmental Restoration Division (ERD) at the LLNL weather-tower site. Mounted on a 2-meter mast are sensors for air temperature, wind speed and direction, relative humidity, net radiation flux, and ground heat flux. Table 1 lists the height of the sensors and the sensor accuracies. These sensors are sampled every second and 15-minute averages are saved by the data logger for retrieval. Average and standard deviation (σ_θ) of wind direction are computed by the Campbell logger (Campbell Scientific, Model CR-10) using polar coordinates as described in Yamartino (1984). This report describes the reduction of continuously monitored data from 15-minute averages to hourly averages. The bulk of this report is dedicated to describing the computation of parameters that characterize the surface boundary layer. The ultimate goal is to provide estimates of the amount of evaporation of water from the surface.

66 PHYSICS

Refer also to citation(s) 33016

33986 (SAND–93-0875C) **MIMD massively parallel methods for engineering and science problems.** Camp, W.J.; Plimpton, S.J. Sandia National Labs., Albuquerque, NM (United States). [1993]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930372–12: 1993 international simulators conference on high performance computing, Arlington, VA (United States), 29 Mar - 1 apr 1993). Order Number DE93019409. Source: OSTI; NTIS; GPO Dep.

MIMD massively parallel computers promise unique power and flexibility for engineering and scientific simulations. In this paper we review the development of a number of software methods and algorithms for scientific and engineering problems which are helping to realize that promise. We discuss new domain decomposition, load balancing, data layout and communications methods applicable to simulations in a broad range of technical field including signal processing, multi-dimensional structural and fluid mechanics, materials science, and chemical and biological systems.

6611 Classical and Quantum Mechanics

Refer also to citation(s) 34029, 34417

33987 (ANL-HEP-CP–93-39) **Thermodynamic q-distributions that aren't.** Vokos, S. (Washington Univ., Seattle, WA (United States). Dept. of Physics); Zachos, C. Argonne National Lab., IL (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38 ;FG06-91ER40614. (CONF-9306203–1: 2. Prague colloquium on quantum groups, Prague (Czech Republic), 24-26 Jun 1993). Order Number DE93017385. Source: OSTI; NTIS; INIS; GPO Dep.

Bosonic q-oscillators commute with themselves and so their free distribution is Planckian. In a cavity, their emission and absorption rates may grow or shrink-and even diverge-but they nevertheless balance to yield the Planck distribution via Einstein's equilibrium method, (a careless application of which might produce spurious q-dependent distribution functions). This drives home the point that the black-body energy distribution is not a handle for distinguishing q-excitations from plain oscillators. A maximum cavity size is suggested by the inverse critical frequency of such emission/absorption rates at a given temperature, or a maximum temperature at a given frequency. To remedy fragmentation of opinion on the subject, we provide some discussion, context, and references.

33988 (INIS-RU–347, pp. 349) **Solution of the inverse scattering problem in flameworks of the P-matrix approach.** Babenko, V.A. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Petrov, N.M. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and*

nuclear structure: Summary of reports for International conference. 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. INVERSE SCATTERING PROBLEM; EIGENFUNCTIONS; EIGENVALUES; MATRICES; PHASE SHIFT; WAVE FUNCTIONS

33989 (INIS-RU–352, pp. 12-15) **On the polarization invariance of the quantum light fields.** Karasev, V.P. AN SSSR, Moscow (Russian Federation). Fizicheskij Inst. 1991. (In Russian). In *Short communications on physics. Experimental and theoretical physics. No. 6.* 42p. Order Number DE94600073. Source: OSTI; NTIS (US Sales Only); INIS.

Polarization properties of light fields were studied. The notion of polarization spin (P-spin) describing double polarization degeneracy of energy-pulsed eigenstates is used to characterize polarization structure of quantum light fields and to reveal its sufficiently quantum peculiarities. A new class of light field states is obtained. The definite similarity of such states with nonpolarized light is noted. Differing from the classic nonpolarized light the P-scalar light is not a result of chaotic mixing of light waves, but it is generated by biphotons having rigid phase correlations. The two-photon laser or circuits of parametric scattering with $SU(2)_p$-invariant interaction Hamiltonians can be ideal generators of P-scalar light.

33990 (LA-UR–93-1562) **Application of Differential Sensitivity Theory to continuum mechanics.** Maudlin, P.J.; Henninger, R.J.; Harstad, E.N. Los Alamos National Lab., NM (United States). [1993]. 11p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-931121–6: Annual winter meeting of the American Society of Mechanical Engineers, New Orleans, LA (United States), 28 Nov - 3 dec 1993). Order Number DE93012732. Source: OSTI; NTIS; GPO Dep.

A sensitivity technique used successfully in the early eighties called Differential Sensitivity Theory (DST) is applied to a system of time-dependent continuum mechanics equations. DST uses adjoint techniques to determine exact sensitivity derivatives, i.e., if R is a calculational result of interest (response R) and α is a calculational input (parameter α_i where the subscript is usually not indicated for convenience), then $\partial R/\partial\alpha_i$ is defined as the sensitivity. The advantage of using DST over other sensitivity analysis techniques is mainly economic: for an n-parameter problem all n sensitivities can be obtained by integrating the solutions from only two calculations, a so-called forward (physical) calculation and its corresponding adjoint calculation. This work describes the derivation and solution of the appropriate set of adjoint and sensitivity equations for the ultimate purpose of computing sensitivities for high-rate twodimensional, multi-component, high deformation problems.

33991 (LUND-MPH–93-02) **Resonant state expansions.** Lind, P. Lund Univ. (Sweden). Dept. of Mathematical Physics. Feb 1993. 46p. Order Number DE94600353. Source: OSTI; NTIS; INIS.

The completeness properties of the discrete set of bound state, virtual states and resonances characterizing the system of a single nonrelativistic particle moving in a central cutoff potential is investigated. From a completeness relation in terms of these discrete states and complex scattering states one can derive several Resonant State Expansions (RSE). It is interesting to obtain purely discrete expansion which, if valid, would significantly simplify the treatment of the continuum. Such expansions can be derived using Mittag-Leffler (ML) theory for a cutoff potential and it would be nice to see if one can obtain the same expansions starting from an eigenfunction theory that is not restricted to a finite sphere. The RSE of Greens functions is especially important, e.g. in the continuum RPA (CRPA) method of treating giant resonances in nuclear physics. The convergence of RSE is studied in simple cases using square well wavefunctions in order to achieve high numerical accuracy. Several expansions can be derived from each other by using the theory of analytic functions and one can the see how to obtain a natural discretization of the continuum. Since the resonance wavefunctions are oscillating with an exponentially increasing amplitude, and therefore have to be interpreted through some regularization procedure, every statement made about quantities involving such states is checked by numerical calculations.Realistic nuclear wavefunctions, generated by a Wood-Saxon potential, are used to test also the usefulness of RSE in a realistic nuclear calculation. There are some fundamental differences between different symmetries of the integral contour that defines the continuum in RSE. One kind of symmetry is necessary to have an expansion of the unity operator that is idempotent. Another symmetry must be used if we want purely discrete expansions. These are found to be of the same form as given by ML. (29 refs.).

6612 Techniques of General Use in Physics

Refer also to citation(s) 33332, 33417, 33515, 33636

33992 (INIS-mf–13549, pp. 92-97) **Laser plasma sources of neutrons and accelerated ions.** Bykovskij, Yu.A. (Moskovskij Fiziko-Tekhnicheskij Inst., Moscow (Russian Federation)); Zubkov, N.V.; Kozlovskij, K.I.; Rzhevskij, A.V.; Tsybin, A.S. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 10.* 214p. Order Number DE94600067. Source: OSTI; NTIS (US Sales Only); INIS.

Neutron and accelerated ion sources are described which are based on the effects of laser radiation with a power density of 10^9-10^{11}W/cm^2 on solid targets in a vacuum. Laser plasma ions are accelerated by means of a coaxial diode with the magnetic insulation of electrons, a collective ion accelerator based on the high-current electron beam, and a high-frequency linear accelerator of ions. This type of source can be applied to solve various problems of materials science, in particular, radiation effects on materials. 6 refs.; 3 figs.

33993 (INIS-RU–347, pp. 425) **Production of quasi-monochromatic gamma radiation for nuclear spectroscopy purpose.** Almaliev, A.N. (Voronezhskij Gosudarstvennyj Univ., Voronezh (Russian Federation)); Batkin, I.S. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. 3 refs. GAMMA RADIATION/ monochromatic radiation; ELECTRON BEAMS; FERROMAGNETIC MATERIALS; KEV RANGE 10-100; MEV RANGE 100-1000; ONDULATOR RADIATION; WIGGLER MAGNETS

33994 (LA-UR–93-2515) **Development of a cryogenic heat pipe.** Prenger, F.C.; Stewart, W.F.; Runyan, J.E. Los Alamos National Lab., NM (United States). [1993]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930703–13: International cryogenic engineering conference and international cryogenic materials conference, Albuquerque, NM (United States), 12-16 Jul 1993). Order Number DE93018448. Source: OSTI; NTIS; GPO Dep.

Heat pipe operating characteristics can be used to advantage in cryogenic systems. Diode operation of the heat pipe, the ability to conduct heat in one direction only, is useful in protecting the heat load if the heat sink temperature rises above the load temperature. Because of this, the heat pipe can be made to act as a thermal switch. A screened-wick, inverted-artery, cryogenic heat pipe was designed, fabricated, and tested. The tests were first conducted with hydrogen and then with oxygen as the working fluid. Heat pipe performance limits were measured as a function of operating temperature, and startup from both the supercritical and the frozen state was demonstrated. The heat pipe was designed to operate as a thermal diode, and transient tests were used to determine the turndown ratio. The heat pipe test results were correlated with the Los Alamos heat pipe computer code and good agreement was obtained between the predicted and measured performance. The heat pipe was developed for spacecraft sensor cooling applications. Test results show significant performance advantages over solid conductors.

33995 (UCRL-ID--112216) **MODIL cryocooler producibility demonstration project results.** Cruz, G.E.; Franks, R.M. Lawrence Livermore National Lab., CA (United States). 24 Jun 1993. 56p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93019213. Source: OSTI; NTIS; INIS; GPO Dep.

The production of large quantities of spacecraft needed by SDIO will require a cultural change in design and production practices. Low rates production and the need for exceedingly high reliability has driven the industry to custom designed, hand crafted, and exhaustingly tested satellites. These factors have mitigated against employing design and manufacturing cost reduction methods commonly used in tactical missile production. Additional challenges to achieving production efficiencies are presented by the SDI spacecraft mission requirement. IR sensor systems, for example, are comprised of subassemblies and components that require the design, manufacture, and maintenance of ultra precision tolerances over challenging operational lifetimes. These IR sensors demand the use of reliable, closed loop, cryogenic refrigerators or active cryocoolers to meet stringent system acquisition and pointing requirements. The authors summarize some spacecraft cryocooler requirements and discuss their observations regarding Industry's current production capabilities of cryocoolers. The results of the Lawrence Livermore National Laboratory (LLNL) Spacecraft Fabrication and Test (SF and T) MODIL's Phase I producibility demonstration project are presented. The current project that involves LLNL and industrial participants is discussed.

33996 (UCRL-JC--112216) **MODIL cryocooler producibility demonstration project results.** Cruz, G.E.; Franks, R.M. Lawrence Livermore National Lab., CA (United States). 7 Apr 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930445--21: Society of Photo-Optical Instrumentation Engineers (SPIE) OE/aerospace science and sensing meeting, Orlando, FL (United States), 11-16 Apr 1993). Order Number DE93017981. Source: OSTI; NTIS; INIS; GPO Dep.

The production of large quantities of spacecraft needed by SDIO will require a cultural change in design and production practices. Low rates production and the need for exceedingly high reliability has driven the industry to custom designed, hand crafted, and exhaustively tested satellites. These factors have mitigated against employing design and manufacturing cost reduction methods commonly used in tactical missile production. Additional challenges to achieving production efficiencies are presented by the SDI spacecraft mission requirement. IR sensor systems, for example, are comprised of subassemblies and components that require the design, manufacture, and maintenance of ultra precision tolerances over challenging operational lifetimes. These IR sensors demand the use of reliable, closed loop, cryogenic refrigerators or active cryocoolers to meet stringent system acquisition and pointing requirements. The authors summarize some spacecraft cryocooler requirements and discuss observations regarding Industry's current production capabilities of cryocoolers. The results of the Lawrence Livermore National Laboratory (LLNL) Spacecraft Fabrication and Test (SF and T) MODIL's Phase I producibility demonstration project is presented.

6613 Other Aspects of Physical Science

Refer also to citation(s) 33356, 34049, 34689

33997 (DOE/ER/40317--12) **[Research in nuclear astrophysics: Stellar collapse and supernovae].** State Univ. of New York, Stony Brook, NY (United States). [1993]. 33p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-87ER40317. Order Number DE93019932. Source: OSTI; NTIS; GPO Dep.

This progress report describes the nuclear astrophysics research activities in the Earth and Space Sciences Department at Stony Brook during the last year. Our research focuses on three aspects of nuclear astrophysics: (1) the equation of state of hot, dense matter, (2) the origin of supernovas and neutron stars, (3) the early cooling epoch of neutron stars. Following a discussion of ongoing research, a series of detailed reports, which summarize each project completed within the last year, is given.

33998 (DOE/ER/40702--3) **Investigation of the relative abundance of heavy versus light nuclei in primary cosmic rays using underground muon bundles.** Sundaralingam, N. Tufts Univ., Medford, MA (United States). Dept. of Physics and Astronomy. 8 Jun 1993. 152p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-92ER40702. Order Number DE93017601. Source: OSTI; NTIS; INIS; GPO Dep.

We study multiple muon events (muon bundles) recorded underground at a depth of 2090 mwe. To penetrate to this depth, the muons must have energies above 0.8 TeV at the Earth's surface; the primary cosmic ray nuclei which give rise to the observed muon bundles have energies at incidence upon the upper atmosphere of 10 to 10^5TeV. The events are detected using the Soudan 2 experiment's fine grained tracking calorimeter which is surrounded by a 14 m $\times$10 m $\times$ 31 m proportional tube array (the "active shield"). Muon bundles which have at least one muon traversing the calorimeter, are reconstructed using tracks in the calorimeter together with hit patterns in the proportional tube shield. All ionization pulses are required to be coincident within 3 microseconds. A goal of this study is to investigate the relative nuclear abundances in the primary cosmic radiation around the "knee" region (10^3 – 10^4 TeV) of the incident energy spectrum. Four models for the nuclear composition of cosmic rays are considered: The Linsley model, the Constant Mass Composition model (CMC), the Maryland model and the Proton-poor model. A Monte Carlo which incorporates one model at a time is used to simulate events which are then reconstructed using the same computer algorithms that are used for the data. Identical cuts and selections are applied to the data and to the simulated events.

33999 (LA-UR--93-2541) **Computational astrophysics: Pulsating stars.** Davis, C.G. Los Alamos National Lab., NM (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9309176--2: 2. international conference on computational physics, Beijing (China), 13-17 Sep 1993). Order Number DE93018369. Source: OSTI; NTIS; INIS; GPO Dep.

The field of computational astrophysics in pulsating star studies has grown considerably since the advent of the computer. Initially calculations were done on the IBM 704 with 32K of memory and now we use the CRAY YMP computers with considerably more memory. Our early studies were for models of pulsating stars using a 1D Lagrangian hydrodynamic code (SPEC) with radiation diffusion. The radiative transfer was treated in the equilibrium diffusion approximation and the hydrodynamics was done utilizing the approximation of artificial viscosity. The early calculations took many hours of 704 CPU time. Early in 1965 we decided to improve on the usual treatment of the radiative transfer used in our codes by utilizing the method of moments, the so-called variable Eddington approximation. In this approximation the material energy field is uncoupled from the radiation energy field and the angular dependence is introduced through the Eddington factor. A multigroup frequency dependent method may also be applied. The Eddington factor is determined by snapshots of the stars structure utilizing a y-line approximation. The full radiative transfer approximation appears necessary in order to understand the light curves for W Virginia stars and may be important for the light curves of RR Lyrae stars. A detailed radiative transfer method does not appear to be necessary for the understanding of Cepheid light curves. A recent improvement to our models for Pulsating stars is in the use of an adaptive mesh scheme to resolve the sharp features in the nonlinear hydrodynamic structure. From these improved structures, better analysis of the radius, velocity, and light curves could be obtained.

34000 (LBL--34240) **Extensions of 2D gravity.** Sevrin, A. Lawrence Berkeley Lab., CA (United States). Jun 1993. 14p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract AC03-76SF00098. Grant PHY90-21139. (UCB-PTH--93/21;CONF-9304184--1: Journees relativistes conference, Brussels (Belgium), 5-7 Apr 1993). Order Number DE93018525. Source: OSTI; NTIS; INIS; GPO Dep.

After reviewing some aspects of gravity in two dimensions, I show that non-trivial embeddings of sl(2) in a semi-simple (super) Lie algebra give rise to a very large class of extensions of 2D gravity. The induced action is constructed as a gauged WZW model and an exact expression for the effective action is given.

34001 (SAND–91-1144) **Fast parallel algorithms for short-range molecular dynamics.** Plimpton, S. Sandia National Labs., Albuquerque, NM (United States). May 1993. 40p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018519. Source: OSTI; NTIS; GPO Dep.

Three parallel algorithms for classical molecular dynamics are presented. The first assigns each processor a subset of atoms; the second assigns each a subset of inter-atomic forces to compute; the third assigns each a fixed spatial region. The algorithms are suitable for molecular dynamics models which can be difficult to parallelize efficiently – those with short-range forces where the neighbors of each atom change rapidly. They can be implemented on any distributed-memory parallel machine which allows for message-passing of data between independently executing processors. The algorithms are tested on a standard Lennard-Jones benchmark problem for system sizes ranging from 500 to 10,000,000 atoms on three parallel supercomputers, the nCUBE 2, Intel iPSC/860, and Intel Delta. Comparing the results to the fastest reported vectorized Cray Y-MP and C90 algorithm shows that the current generation of parallel machines is competitive with conventional vector supercomputers even for small problems. For large problems, the spatial algorithm achieves parallel efficiencies of 90% and the Intel Delta performs about 30 times faster than a single Y-MP processor and 12 times faster than a single C90 processor. Trade-offs between the three algorithms and guidelines for adapting them to more complex molecular dynamics simulations are also discussed.

34002 (SAND–93-0457C) **Dynamical behavior of octahedrite from the Henbury meteorite.** Furnish, M.D. (Sandia National Labs., Albuquerque, NM (United States)); Gray, G.T. III; Remo, J.L. Sandia National Labs., Albuquerque, NM (United States). 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930676–26: 14. international conference of the International Association for the Advancement of High Pressure Science and Technology, Colorado Springs, CO (United States), 27 Jun - 2 jul 1993). Order Number DE93018834. Source: OSTI; NTIS; GPO Dep.

A suite of dynamic property measurements and characterization studies on an iron-nickel single crystal from the Henbury octahedrite containing Widmanstaetten intergrowths of kamacite and taenite (initial density 7.810) has been performed. These measurements include six impact tests (wave profile compression/release) over the stress range 2-20 GPa, metallography, quasi-static and Hopkinson bar mechanical testing, and ultrasonic mapping and sound velocity measurements. A cryogenic impact test was included to evaluate effects of a brittle/ductile transition which has been reported at 200K. Temperature sensitivity of the dynamic behavior was measured at high and low strain rates. The impact test results show loading strength (HEL), Hugoniot and $\alpha \rightarrow \varepsilon$ transition signatures to be similar to those for Armco iron, and do not show evidence for a ductile-brittle transition at these extremely high strain rates. Metallographic analyses, quasi-static and Hopkinson bar testing suggest that the material is in a work-hardened state and that kamacite properties dominate the bulk octahedrite properties.

34003 (SAND–93-0916C) **Visualization for applications in shock physics.** Pavlakos, C.J.; Campbell, D.L. Sandia National Labs., Albuquerque, NM (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-931080–1: Visualization '93, San Jose, CA (United States), 25-29 Oct 1993). Order Number DE93012849. Source: OSTI; NTIS; GPO Dep.

This case study presents work being done to provide visualization capabilities for a family of codes at Sandia in the area of shock physics. The codes, CTH and Parallel CTH, are running in traditional supercomputing as well as massively parallel environments. These are Eulerian codes which produce data on structured grids. Data sets can be large, so managing large data is a priority. A supercomputing-based distributed visualization environment has been implemented to support such applications. This environment, which is based in New Mexico, is also accessible from our branch site in California via a long haul FDDI/ATM link. Functionality includes the ability to track ongoing simulations. A custom visualization file has been developed to provide efficient, interactive access to result data. Visualization capabilities are based on the commercially available AVS software. A few example results are presented, along with a brief discussion of future work.

34004 (SAND–93-1388) **Using computerized tomography to determine ionospheric structures: Part 1, Motivation and basic approaches.** Vittitoe, C.N. Sandia National Labs., Albuquerque, NM (United States). Aug 1993. 44p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018903. Source: OSTI; NTIS; GPO Dep.

Properties of the ionosphere are reviewed along with its correlations with other geophysical phenomena and with applications of ionospheric studies to communication, navigation, and surveillance systems. Computer tomography is identified as a method to determine the detailed, three-dimensional distribution of electron density within the ionosphere. Several tomography methods are described, with a basic approach illustrated by an example. Limitations are identified.

34005 (SAND–93-1389) **Using computerized tomography to determine ionospheric structures: Part 2, A method using curved paths to increase vertical resolution.** Vittitoe, C.N. Sandia National Labs., Albuquerque, NM (United States). Aug 1993. 41p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018904. Source: OSTI; NTIS; GPO Dep.

A method is presented to unfold the two-dimensional vertical structure in electron density by using data on the total electron content for a series of paths through the ionosphere. The method uses a set of orthonormal basis functions to represent the vertical structure and takes advantage of curved paths and the eikonical equation to reduce the number of iterations required for a solution. Curved paths allow a more thorough probing of the ionosphere with a given set of transmitter and receiver positions. The approach can be directly extended to more complex geometries.

34006 (UCRL–53809-92) **Institute of Geophysics and Planetary Physics, 1992: Annual report, October 1, 1991–September 30, 1992.** Ryerson, F.J.; Budwine, C.M. (eds.). Lawrence Livermore National Lab., CA (United States). 14 Jun 1993. 117p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93019209. Source: OSTI; NTIS; GPO Dep.

This report contains brief discussions on topics in the following areas: High-pressure sciences; astrophysics; and geosciences.

34007 (UCRL–93018172) **Nonlinear self-focus of pulsed-wave beams in Kerr media.** Judkins, J.B. Lawrence Livermore National Lab., CA (United States). 1992. 186p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93018172. Source: OSTI; NTIS; GPO Dep.

Thesis submitted to Univ. of Arizona, Tucson, AZ.

A modified finite-difference time-domain method for solving Maxwell's equations in nonlinear media is presented. This method allows for a finite response time to be incorporated in the medium, physically creating dispersion and absorption mechanisms. The technique models electromagnetic fields in two space dimensions and time and encompasses both the TE_z and TM_z set of decoupled field equations. Aspects of an ultra-short pulsed Gaussian beam are studied in a variety of linear and nonlinear environments to demonstrate that the methods developed here can be used efficaciously in the modeling of pulses in complex problem space geometries even when nonlinearities are present.

34008 (UCRL-ID–114560) **Determining the refractive index of a $\lambda/4$ thin film on a thick substrate from a transmittance measurement.** Chow, R.; Loomis, G.E.; Biltoft, P. Lawrence Livermore National Lab., CA (United States). Jun 1993. 12p. Sponsored

by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93019584. Source: OSTI; NTIS; GPO Dep.

The refractive index is a key optical constant required by optical thin film designers. The coater-designer team must constantly verify the refractive indices of the non-absorbing optical thin films since the refractive index of a deposited material can vary by switching coating systems or operators as well as expected changes during the course of a coating run. A transmittance measurement on a spectrophotometer is an easy and accurate (usually to within ±0.5% spread) method of determining the refractive index. In one technique, the refractive index is obtained from visually curve-fitting a calculated (using a thin film design program and selecting the refractive index) transmittance spectrum to the measured transmittance spectrum. There are two other techniques which are discussed in this report: A quick, approximate method vs. the exact derivation. What the authors have not been able to find in the literature is the exact transmittance dependence as a function of the refractive indices (layers) through which the light passes and which accounts for the substrate back reflections. There are undocumented approximation methods as well as one in the literature by Cheremukhin and Rozhnox. Otherwise, most texts either derive the transmittances through optical multilayers or just the effect of back reflections on the transmittance for thick substrates. Without correcting for substrate back reflections, the derived refractive indices from the measured transmittances are in error by as much as 10%. In this work, the authors have utilized both an exact and an approximate method of determining the refractive index of the film. It is found that both the exact and approximate methods of determining the refractive index of thin optical coatings are within the measurement errors of commercially available spectrophotometers.

34009 (UCRL-JC–112660) **The tracking of interfaces in an electron-beam vaporizer.** Westerberg, K.W. (Lawrence Livermore National Lab., CA (United States)); McClelland, M.A.; Finlayson, B.A. Lawrence Livermore National Lab., CA (United States). Mar 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930785–2: 8. international conference on numerical methods in laminar and trubulent flow, Swansea (United Kingdom), 18-23 Jul 1993). Order Number DE93017975. Source: OSTI; NTIS; INIS; GPO Dep.

A numerical analysis is made of the material and energy flow in an electron beam vaporizer. In this system the energy from an electron beam heats metal confined in a water-cooled crucible. Metal is vaporized from a liquid pool circulating in a shell of its own solid. A modified Galerkin finite element method is used to calculate the flow and temperature fields along with the interface locations. The mesh is parameterized with spines which stretch and pivot as the phase boundaries move. The discretized equations are arranged in an "arrow" matrix and solved using the Newton-Raphson method. Results are given for an experimental aluminum vaporizer. The effects of buoyancy and capillary driven flow are included along with the surface contributions of vapor thrust, latent heat, thermal radiation, and crucible contact resistance.

34010 (UCRL-JC–113625) **Flow volumes for interactive vector field visualization.** Max, N.; Becker, B.; Crawfis, R. Lawrence Livermore National Lab., CA (United States). 6 Apr 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-931080–2: Visualization '93, San Jose, CA (United States), 25-29 Oct 1993). Order Number DE93017102. Source: OSTI; NTIS; GPO Dep.

Flow volumes are the volumetric equivalent of stream lines. They provide more information about the vector field being visualized than do stream lines or ribbons. Presented is an efficient method for producing flow volumes, composed of transparently rendered tetrahedra, for use in an interactive system. The problems of rendering, subdivision, sorting, rendering artifacts, and user interaction are dealt with.

34011 (UCRL-JC–113747) **Weak neutral currents and collapse initiated supernova.** Wilson, J.R. Lawrence Livermore National Lab., CA (United States). 19 Mar 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930293–4: International symposium on 30 years of neutral currents, Los Angeles, CA (United States), 3-5 Feb 1993). Order Number DE93018652. Source: OSTI; NTIS; GPO Dep.

Since 1974 the neutrino processes mediated by neutral currents have been a part of supernova (SN) modeling calculations. In this report only present day SN calculations will be discussed. First I will give brief description of the SN computer model and an outline of the explosion process as depicted by that model. Then I will discuss the role weak neutral current (WNC) processes play in this explosion process. Finally, I will discus inelastic scattering of tau neutrinos by heavy elements in WNC or Earth as a mechanism for measuring the mass of tau neutrino.

6620 Physics of Elementary Particles and Fields

Refer also to citation(s) 33478, 34063

34012 (ANL-HEP-TR–93-22) **High Energy Physics Division semiannual report of research activities, July 1, 1992–December 30, 1992.** Schoessow, P.; Moonier, P.; Talaga, R.; Wagner, R. (eds.). Argonne National Lab., IL (United States). Jul 1993. 102p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93019681. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes the research conducted in the High Energy Physics Division of Argonne National Laboratory during the period of July 1, 1992–December 30, 1992. Topics covered here include experimental and theoretical particle physics, advanced accelerator physics, detector development, and experimental facilities research. Lists of division publications and colloquia are included.

34013 (BNL–34518-Ed.9) **AGS experiments: 1990, 1991, 1992: Ninth edition.** Depken, J.C. Brookhaven National Lab., Upton, NY (United States). Apr 1993. 170p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE93019826. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains a description of the following: AGS Experimental Area - High Energy Physics FY 1993 and Heavy Ion Physics FY 1993; Table of Beam Parameters and Fluxes; Experiment Schedule "as run"; Proposed 1993 Schedule; A listing of experiments by number; Two-page summaries of each experiment begin here, also ordered by number; Publications of AGS Experiments; and List of AGS Experimenters.

34014 (DOE/ER/40319–T3) **High energy physics program: Task A, Experiment and theory; Task B, Numerical simulation: Progress report, July 1, 1988–June 30, 1993.** Florida State Univ., Tallahassee, FL (United States). Dept. of Physics. [1993]. 90p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-87ER40319. Order Number DE93018140. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses research in High Energy Physics at Florida State University. Contained in this paper are: highlights of activities during the past few years; five year summary; fixed target experiments; collider experiments; SSC preparation, detector development and detector construction; computing, networking and VAX upgrade to ALPHA; and particle theory programs.

34015 (DOE/ER/40676–T1) **Research in particle physics.** Boston Univ., MA (United States). Dept. of Physics. Aug 1993. 150p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER40676. Order Number DE93040875. Source: OSTI; NTIS; INIS; GPO Dep.

This proposal presents the research accomplishments and ongoing activities of Boston University researchers in high energy physics. Some changes have been made in the structure of the program from the previous arrangement of tasks. Task B, Accelerator Design Physics, is being submitted as a separate proposal for an independent grant; this will be consistent with the nature of the research and the source of funding. We are active in seven principal areas which will be discussed in this report: Colliding Beams - physics of e^+e^- and $\bar{p}p$ collisions; MACRO Experiment - search for magnetic monopoles and study of cosmic rays; Proton Decay - search for nucleon instability and study of neutrino interactions; Particle Theory - theoretical high energy particle physics, including two Outstanding Junior Investigator awards; Muon G-2 - measurement of the anomalous magnetic moment of the muon; SSCintcal -

calorimetry for the GEM Experiment; and Muon detectors for the GEM Experiment.

34016 (DOE/ER/40684–3) **Research in high energy physics: Progress report, July 1, 1992–June 30, 1993.** Rosen, J.; Block, M.; Buchholz, D.; Gobbi, B.; Schellman, H.; Miller, D.; Braaten, E.; Oakes, R. Northwestern Univ., Evanston, IL (United States). Jul 1993. 73p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER40684. Order Number DE93018031. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses research being conducted in High Energy Physics at Northwestern University.

34017 (DOE/ER/40702–4) **High Energy Physics at Tufts University: Progress report, 1992–1993.** Tufts Univ., Medford, MA (United States). 15 Jul 1993. 98p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-92ER40702. Order Number DE93018299. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the following topics: Fermilab fixed target experiments; Soudan II nucleon decay project; Physics at the proton-antiproton collider at $\sqrt{s}$ = 1.8 TeV; The Solenoidal Detector for the supercollider; Neutrino telescope proposal; Polarization in massive quark and hadron production; Production characteristics of top quarks; Scattering, spin dependence and mass corrections in Skyrmion models; and computation and networking.

34018 (DOE/ER/40704–2-Task-A) **Task A: Yale Accelerator Users Group (YAUG): Second technical progress report, November 1, 1992–October 31, 1993.** Adair, R.K.; Sandweiss, J.; Schmidt, M. Yale Univ., New Haven, CT (United States). Dept. of Physics. 6 Jul 1993. 47p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-92ER40704. Order Number DE93018417. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the following topics: Yaug collider detector program; E-791: continued study of heavy flavors at TPL; Hadroproduction of charm and beauty; Search for composite objects produced in relativistic heavy ion collisions; and high energy physics computer facility.

34019 (DOE/ER/40730–1) **Investigation of physical structures and interactions at high energy: Progress report, June 1, 192–May 31, 1992.** Anderson, W.E.; Hauptman, J.M.; Qui, J. Ames Lab., IA (United States). 31 May 1993. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-92ER40730. Order Number DE93014444. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains discussions on the following topics: Experimental program at the Fermilab Tevatron Collider: FNAL E-740; Experimental program at the superconducting super collider: Solenoidal detector collaboration; Computation development program at Iowa State University: Batch after twilight running and parallel processing; Experimental program at the University of Hawaii: Deep underwater muon and neutrino detector; Global analysis of parton distributions; high energy direct photon production; photon fragmentation functions; single transverse-spin asymmetry; associated production of Higgs Boson at collider energies; Cronin effect in photoproduction and deeply inelastic scattering; and heavy meson production.

34020 (DOE/FTR–93015950) **Travel to Japan regarding radioactive beam aspects of high energy nuclear physics research: Foreign trip report, May 29–June 4, 1993.** Hendrie, D.L. USDOE, Washington, DC (United States). 10 Jun 1993. 31p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93015950. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report contains a review of the 15th meeting of the US/Japan Committee on High Energy Physics.

34021 (LBL–91-Rev.) **Current experiments in elementary particle physics: Revised.** Galic, H. (Stanford Univ., CA (US). Stanford Linear Accelerator Center); Wohl, C.G.; Armstrong, B.; Dodder, D.C.; Klyukhin, V.I.; Ryabov, Yu.G.; Illarionova, N.S.; Lehar, F.; Oyanagi, Y.; Olin, A. Lawrence Berkeley Lab., CA (United States); Stanford Linear Accelerator Center, Menlo Park, CA (United States). Jun 1992. 158p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract AC03-76SF00098 ;AC03-76SF00515. Grant PHY86-15529. Order Number DE93040296. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains summaries of 584 current and recent experiments in elementary particle physics. Experiments that finished taking data before 1986 are excluded. Included are experiments at Brookhaven, CERN, CESR, DESY, Fermilab, Tokyo Institute of Nuclear Studies, Moscow Institute of Theoretical and Experimental Physics, KEK, LAMPF, Novosibirsk, Paul Scherrer Institut (PSI), Saclay, Serpukhov, SLAC, SSCL, and TRIUMF, and also several underground and underwater experiments. Instructions are given for remote searching of the computer database (maintained under the SLAC/SPIRES system) that contains the summaries.

6621 General Theory of Particles and Fields

Refer also to citation(s) 34056, 34058

34022 (CONF-9209321–1) **Experimental consequences of supersymmetry.** Baer, H. (Florida State Univ., Tallahassee, FL (United States). Dept. of Physics); Tata, X. Florida State Univ., Tallahassee, FL (United States). Dept. of Physics; Hawaii Univ., Honolulu, HI (United States). Dept. of Physics and Astronomy. [1992]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-87ER40319 ;AM03-76SF00235. From 23. Workshop of the INFN Eloisatron Project "Properties of SUSY Particles"; Erice (Italy); 28 Sep - 4 oct 1992. Order Number DE93018270. Source: OSTI; NTIS; INIS; GPO Dep.

After a brief review of the assumptions of the Minimal Supersymmetric Model (MSSM) we study the constraints on the masses of various sparticles as well as on the MSSM Higgs bosons from experiments at the Fermilab Tevatron and at LEP. We also review the range of Higgs boson masses that can be searched for at LEP 200. We then discuss the simulation of supersymmetric particle production at hadron colliders and briefly discuss event generators that we have been using in our analyses. Next, we discuss various signals that can be searched for in the present run of the Tevatron. We conclude with a study of the prospects for the detection of sparticles as well as MSSM Higgs bosons in experiments at hadron supercolliders, assuming that these are too heavy to be discovered at the Tevatron or at LEP 200.

34023 (DOE/ER/10713–T5) **Investigations in gauge theories, topological solitons and string theories: Final report.** Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (United States). [1993]. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AS05-80ER10713. Order Number DE93015029. Source: OSTI; NTIS; INIS; GPO Dep.

This is the Final Report on a supported research project on theoretical particle physics entitled "Investigations in Gauge Theories, Topological Solitons and String Theories." The major theme of particle theory pursued has been within the rubric of the standard model, particularly on the interplay between symmetries and dynamics. Thus, the research has been carried out primarily in the context of gauge with or without chiral fermions and in effective chiral lagrangian field theories. The topics studied include the physical implications of abelian and non-abelian anomalies on the spectrum and possible dynamical symmetry breaking in a wide range of theories. A wide range of techniques of group theory, differential geometry and function theory have been applied to probe topological and conformal properties of quantum field theories in two and higher dimensions, the breaking of global chiral symmetries by vector-like gauge theories such as QCD,the phenomenology of a possibly strongly interacting Higgs sector within the minimal standard model, and the relevance of solitonic ideas to non-perturbative phenomena at SSC energies.

34024 (DOE/ER/40682–23) **Testing the superweak theory of CP violation in neutral B decays.** Soares, J.M.; Wolfenstein, L. Carnegie-Mellon Univ., Pittsburgh, PA (United States). Dept. of Physics. 21 Jan 1992. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER40682 ;AC02-76ER03066. (CMU-HEP–92-01). Order Number DE93018866. Source: OSTI; NTIS; INIS; GPO Dep.

In order to rule out the superweak theory for CP violation, future experiments will try to find a difference between the CP-violating asymmetries in the decays $B^0 \rightarrow \psi K_s$ and $B^0 \rightarrow \pi^+\pi^-$. However, Winstein recently noted that, for some acceptable values of the CKM parameters, the standard model would give equal asymmetry parameters for these decays just as the superweak theory does. In this paper we show that, by considering both tree and penguin contributions to the decay amplitudes, the test can still be effective if a third asymmetry is measured with enough precision.

34025 (DOE/FTR–93014982) **Travel to Japan for the 15th meeting of US/Japan Committee on High Energy Physics: Foreign trip report, May 31–June 1, 1993.** Rubinstein, R. Fermi National Accelerator Lab., Batavia, IL (United States). 4 Jun 1993. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. Order Number DE93014982. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report contains a review of the 15th meeting of the US/Japan committee an High Energy Physics.

34026 (FNAL/C–93/157-E) **SUSY searches at CDF.** Hu, Ping. CDF collaboration. Fermi National Accelerator Lab., Batavia, IL (United States). Jun 1993. 16p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-9303203–1: SUSY 93 workshop, Boston, MA (United States), 29 Mar - 1 apr 1993). Order Number DE93017812. Source: OSTI; NTIS; INIS; GPO Dep.

A set of jet events with large amount of Missing E_{Tau} from the Fermilab CDF experiment was analyses to search for SUSY signature. No significant signals were observed above the Standard Model background. Some effects of some SUSY parameters on the squark and gluino mass limits are presented.

34027 (IC–93/165) **BRST operator for superconformal algebras with quadratic nonlinearity.** Khviengia, Z. (Texas A and M Univ., TX (United States). Center for Theoretical Physics); Sezgin, E. International Centre for Theoretical Physics, Trieste (Italy). Jul 1993. 13p. (CTP-TAMU–27/93,hep-th/9307043.). Order Number DE94600358. Source: OSTI; NTIS (US Sales Only); INIS.

We construct the quantum BRST operators for a large class of superconformal and quasi-superconformal algebras with quadratic nonlinearity. The only free parameter in these algebras is the level of the (super) Kac-Moody sector. The nilpotency of the quantum BRST operator imposes a condition on the level. We find this condition for (quasi) superconformal algebras with a Kac-Moody sector based on a simple Lie algebra and for the $Z_2 \times Z_2$-graded superconformal algebras with a Kac-Moody sector based on the superalgebra osp(N modul 2M) or sl (N + 2 modul N). (author). 22 refs, 3 tabs.

34028 (LITH-MAT-R–93-05) **A new conformal-invariant nonlinear spinor equation.** Fushchych, W.; Shtelen, W.; Basarab-Horwath, P. Linkoeping Univ. (Sweden). Dept. of Mathematics. 3 Feb 1993. 10p. Order Number DE94600360. Source: OSTI; NTIS; INIS.

We propose a new model for a spinor particle, based on a nonlinear Dirac equation. We invoke group invariance and use symmetry reduction in order to obtain a multiparameter family of exact solutions of the proposed equation. (authors).

34029 (OUP–93-09) **A connection between plane and cylindrical symmetry in general relativity.** Jensen, B.; Kucera, J. Oslo Univ. (Norway). Fysisk Inst. May 1993. 7p. Order Number DE94600359. Source: OSTI; NTIS; INIS.

A new static and singularity free solution of Einsteins equations, representing an infinitely long and straight hollow cylinder of finite thickness, is presented. The cylinder wall is composed of an incompressible, perfect fluid. The metric inside the wall is obtained from a known plane symmetric solution. This metric is matched smoothly to two different axisymmetric Kasner vacuum solutions. The vacuum on one side of the cylinder has a non-vanishing intrinsic curvature, while the vacuum on the other side is flat and non-simply connected. 4 refs.

6622 Specific Theories and Interaction Models; Particle Systematics

Refer also to citation(s) 34011, 34023, 34040, 34045, 34239, 34242

34030 (BUP–1992-15) **Global features of relativistic heavy ion collisions at SPS, RHIC and LHC energies in string fusion model.** Bravina, L.V. (Bergen Univ. (Norway)); Csernai, L.P.; Amelin, N.S.; Braun, M.A.; Pajares, C. Bergen Univ. (Norway). Dept. of Physics. Oct 1992. 16p. Order Number DE94600365. Source: OSTI; NTIS; INIS.

Global characteristics of hh, hA and AA collisions at SPS, RHIC and LHC energies are examined within the Monte Carlo string fusion model (SFM). The possible influence of string fusion on the basic features of relativistic heavy ion collisions is studied. Particularly, in AA interactions at ultra-relativistic energies, string fusion can lead to a reduction of multiple production with relative enhancement of the baryon component. 25 refs., 4 figs., 1 tab.

34031 (FNAL/C–93/163-E) **QCD tests and new physics search with jets at CDF.** Zanetti, A.M. (Istituto Nazionale di Fisica Nucleare, Trieste (Italy)). CDF Collaboration. Fermi National Accelerator Lab., Batavia, IL (United States). Jun 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-9303171–5: 28. Recontres de Moriond conference on electroweak interaction and unified theories, Les Arcs (France), 13-20 Mar 1993). Order Number DE93017805. Source: OSTI; NTIS; INIS; GPO Dep.

The dijet invariant mass spectrum at a center of mass energy $\sqrt{s}$ = 1.8 TeV measured at the Tevatron Collider by CDF in the 1988–1989 run is presented. Comparison with leading order and next-to-leading order QCD theoretical calculation is performed. A search for a possible quark compositeness and for axigluons, while not showing evidence for new physics, allows one to put limits on the compositeness mass scale K_c and on the axigulon mass M_a. Preliminary results for the inclusive jet and the total transverse energy cross section from the high statistics data collected in the present run are shown.

34032 (INS–965) **Nucleon-nucleon scattering lengths in QCD sum rules.** Kondo, Y.; Morimatsu, O. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Feb 1993. 14p. Order Number DE93520239. Source: OSTI; NTIS; INIS.

Nucleon-nucleon scattering lengths are calculated using QCD sum rules. The calculation is based on the observation that the coefficient of the second-order pole term of the nucleon correlation function is proportional to the nucleon-nucleon scattering length at the threshold. By applying the Borel sum rules, we express the scattering length in terms of the expectation values of the quark-gluon field operators with respect to the one-nucleon state. The scattering lengths calculated are in qualitative agreement with the experiment. It is also shown that in the linear density approximation the nucleon mass shift in nuclear matter is related to the nucleon-nucleon scattering length. It is concluded that the recent calculations of the effective nucleon mass in nuclear matter using QCD sum rules with linear density approximation for the condensates should be interpreted in this way. (author).

34033 (KFKI–1992-31/A) **Multi-heavy baryons in ultrarelativistic heavy ion collisions.** Levai, P.; Zimanyi, J. Hungarian Academy of Sciences, Budapest (Hungary). Central Research Inst. for Physics. Nov 1992. 14p. Order Number DE94600366. Source: OSTI; NTIS (US Sales Only); INIS.

Multi-heavy baryon yields in heavy ion collisions were calculated using an extended version of combinatoric break-up model for the description of hadron formation, and for the prediction of the coalescence probability of two or three charm quarks. The combinatoric break-up model, describing the rehadronisation of the quark-gluon matter, needs the quark and gluon content of the very high energy density matter before rehadronisation as an input. An estimation for the expected number of multi-charmed baryons (with two or three heavy quarks) in the RHIC and LHC colliders is presented. (R.P.) 7 refs.; 2 figs.; 2 tab.

34034 (LUNFD6-TFME–1025-1-14-1993) **Aspects of the QCD cascade.** Olsson, Magnus. Lund Univ. (Sweden). Dept. of

Theoretical Physics. Feb 1993. 17p. Order Number DE94600364. Source: OSTI; NTIS; INIS.

A model is proposed for the production of transverse jets from diffractively excited protons. We propose that transverse jets can be obtained from gluonic bremsstrahlung in a way similar to the emission in DIS. Qualitative agreement is obtained between the model and the uncorrected data published by the UA8 collaboration. Perturbative QCD in the MLLA approximation is applied to multiple jet production in e^+e^--annihilation. We propose modified evolution equations for deriving the jet cross sections, defined in the 'k_t' or 'Durham' algorithm. The mean number of jets as a function of the jet resolution is studied, and analytical predictions are compared to the results of MC simulations. We also study a set of differential-difference equations for multiplicity distributions in e^+e^--annihilations, supplemented with appropriate boundary conditions. These equations take into account nonsingular terms in the GLAP splitting functions as well as kinematical constraints related to recoil effects. The presence of retarded terms imply that the cascade develops more slowly and reduces the fluctuations. The solutions agree well with MC simulations and experimental data. (authors).

6623 Specific Interactions, Decays and Processes

Refer also to citation(s) 34022, 34024, 34066, 34278

34035 (ANL-HEP-CP–93-24) **Inverse neutrinoless double β-decay at the NLC?.** Rizzo, T.G. Argonne National Lab., IL (United States). May 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930449–1: International workshop on physics and instrumentation at future linear colliders, Kona, HI (United States), 26-30 Apr 1993). Order Number DE93017397. Source: OSTI; NTIS; INIS; GPO Dep.

The NLC may allow us to search for the 'inverse' process to neutrinoless double-β decay, $e^-e^- \rightarrow W^-W^-$, which probes the existence of Majorana masses for neutrinos. Expectations for the observation of this process in both the Standard Model and its extension, the Left-Right Symmetric Model, are examined.

34036 (ANL/PHY/CP–80056) **Unitary $\pi\pi$N model of N* excitations in πN and γN reactions.** Lee, T.S.H. Argonne National Lab., IL (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9305241–2: 6. international workshop on perspectives in intermediate energy nuclear physics, Trieste (Italy), 4-7 May 1993). Order Number DE93017422. Source: OSTI; NTIS; INIS; GPO Dep.

A unitary model is presented to describe N* excitations in πN and γN reactions. Preliminary results of πN scattering in P_{11} and P_{33} channels are compared with the data.

34037 (BUP–1992-01) **Two-loop ladder diagram contributions to Bhabha scattering. II: Asymptotoc results for high energies.** Bjoerkevoll, K.S. (Bergen Univ., Dept. of Physics (Norway)); Osland, P.; Faeldt, G. Bergen Univ. (Norway). Dept. of Physics. 1992. 37p. Order Number DE94600369. Source: OSTI; NTIS; INIS.

The authors determine the dominant contribution to the Bhabha scattering amplitudes arising from the six two-loop ladder-like diagrams in the limit $s>>t>>m^2>>\lambda^2$, where λ is the photon mass. A method is developed that allows for the simultaneous presence of these four different scales. While each individual diagram contributes four logarithmic factors to the amplitude, the two leading orders cancel, leaving only two such factors in the sum. They are precisely the logarithmic terms associated with two infrared photons. Integrals are also given for the terms that could possibly give single logarithms, but their sum is expected to vanish. 9 refs.

34038 (BUP–1992-06) **Two-loop ladder diagram contributions to Bhabha scattering. III: The Φ^3-limit of QED.** Bjoerkevoll, K.S. (Bergen Univ., Dept. og Physics (Norway)); Osland, P.; Faeldt, G. Bergen Univ. (Norway). Dept. of Physics. 1992. 30p. Order Number DE94600370. Source: OSTI; NTIS; INIS.

The authors evaluate, in the high-energy limit, the sum of the Feynman amplitudes corresponding the six two-loop ladder-like diagrams in Bhabha scattering. This is the limit where $s\rightarrow\infty$, while t, the electron mass m and the photon mass λ are all being held fixed. In this limit the sum of the six Feynman amplitudes does not depend on the electron mass. When specialized to the region $s>>t>>m^2>>\lambda^2$, this result complements the one previously obtained. The connection with Φ^3 theory is also investigated. 6 refs.

34039 (DOE/ER/40368–4) **Studies of high energy phenomena using muons: Final progress report.** Hedin, D.; Kaplan, D.; Green, J. Northern Illinois Univ., De Kalb, IL (United States). [1993]. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-87ER40368. Order Number DE93013190. Source: OSTI; NTIS; INIS; GPO Dep.

This report covers the activities of the NIU high energy physics group as supported by DOE contract AC02-87ER40368 during the period from July of 1990 to June of 1991 and from February to March 1992. Our group has three main efforts which will be discussed in this paper. The first is the D0 experiment at the Fermilab proton-antiproton collider, with major emphasis on its muon system. The second is the involvement of a portion of the group in Fermilab Experiment 789 which involved detection of meson decays. Finally, we discuss our work with the SDC collaboration at the SSC.

34040 (DOE/ER/40412–6) **The study of the phase structure of hadronic matter by searching for the deconfined quark-gluon phase transition using 2 TeV $\bar{p}$-p collisions; and by searching for critical phenomena in an exclusive study of multifragmentation using 1 GeV/nucleon heavy ion collisions: Progress report, January 1–December 31, 1993.** Scharenberg, R.; Hirsch, A.; Tincknell, M. Purdue Univ., Lafayette, IN (United States). Dept. of Physics. 15 Sep 1993. 61p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-88ER40412. Order Number DE93018925. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the Fermilab experiment E735 which is dedicated to the search for the quark-gluon plasma from proton-antiproton interactions; multifragmentation using the EOS-TPC; STAR R&D; silicon avalanche diodes as direct time-of-flight detectors; and soft photons at the AGS-E855.

34041 (DOE/FTR–93016212) **Travel to France for a seminar at DESY on early results from 1.8 TeV $\bar{p}p$ collisions at D0: Foreign trip report, March 7–21, 1993.** Demarteau, M. Fermi National Accelerator Lab., Batavia, IL (United States). 10 Jun 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. Order Number DE93016212. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Preliminary results from D0 are presented on properties of the $W^{\pm}$ and Z^0 electroweak gauge bosons, using final states containing electrons and muons. In particular, preliminary measurements of the $W^{\pm}$ and Z^0 production cross sections with decay into final states containing electrons are shown and a status report on the determination of M_W/M_Z is given.

34042 (FNAL/C–93/088) **Charmonium physics from $\bar{p}p$ interactions.** Ray, R. Fermi National Accelerator Lab., Batavia, IL (United States). Apr 1993. 49p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-920847–2: International conference on hadron spectroscopy, College Park, MD (United States), 12-16 Aug 1992). Order Number DE93017809. Source: OSTI; NTIS; INIS; GPO Dep.

Heavy quarkonium is perhaps the best QCD laboratory in existence. Much of what we presently know about the fundamental interactions in nature has resulted from the study of two-body bound states. The hydrogen atom, the deuteron and positronium have provided valuable mechanisms for studying quantum mechanics, the theory of nuclear forces and QED. In the same way, one might hope that the study of two-body bound state systems built from heavy quarks will lead to a detailed understanding of at least some of the fundamental properties of strong interactions. While it is possible to gain some qualitative insights into strong interactions by studying bound states built from light quarks, it is not possible to reach more precise conclusions because of the additional complexities introduced by large relativistic corrections and long range confinement. Charmonium, $c\bar{c}$ bound states, has provided us with the first QCD laboratory where the system could be considered to be at least approximately non-relativistic while at the same time lending itself to perturbative calculations. The substantial mass of the charmed quark ($m_c \sim 1.5$ GeV) corresponds to bound states

sufficiently small to begin to probe the asymptotically free component of the strong interaction. The study of $c\bar{c}$ as well as $b\bar{b}$ bound states has greatly enhanced our understanding of the strong interaction between elementary particles. The scope of this article will be to review what has been learned to date, particularly on the experimental front, as well as to look at what remains to be done.

34043 (FNAL/C–93/166-E) **Ratios of cross sections of carbon, calcium and lead at low x_{Bj} in inelastic muon scattering.** Carroll, T.J. (Illinois Univ., Chicago, IL (US)). E665 Collaboration. Fermi National Accelerator Lab., Batavia, IL (United States). Jun 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. (CONF-930363–5: 28. conference on quantum chromodynamics and high energy hadronic interactions, Les Arcs (France), 13-27 Mar 1993). Order Number DE93017810. Source: OSTI; NTIS; INIS; GPO Dep.

Shadowing is observed in the per nucleon cross sections of carbon, calcium and lead, as compared to deuterium. Preliminary cross section ratios are presented in the kinematic region $x_{Bj} > 0.0001$ and $Q^2 \geq 0.1$. The data were taken by Fermilab experiment E665 using inelastically scattered events from muons of mean incident momentum 468 GeV/c.

34044 (INIS-RU–347, pp. 195) **Effects of non-zero mass, electromagnetic interactions and helicity of neutrino in elastic neutrino (antineutrino) -electron scattering.** Kerimov, B.K. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation)); Safin, M.Ya. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. 2 refs. NEUTRINOS/helicity; NEUTRINOS/mass; ANTINEUTRINO-ELECTRON INTERACTIONS; CONSERVATION LAWS; CROSS SECTIONS; ELECTROMAGNETIC FORM FACTORS; NEUTRAL CURRENTS; NEUTRINO-ELECTRON INTERACTIONS; NEUTRINOS; HELICITY; MASS

34045 (INIS-RU–347, pp. 196) **Y-distributions of electrons from νe and antiνe scatterings as test for study of standard electroweak model.** Romanov, Yu.I. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. 2 refs. ANTINEUTRINO-ELECTRON INTERACTIONS/weinberg lepton model; NEUTRINO-ELECTRON INTERACTIONS/weinberg lepton model; DIFFERENTIAL CROSS SECTIONS; ELECTRONS; POLARIZED TARGETS; RECOILS

34046 (INIS-RU–347, pp. 348) **Description of hadron-hadron interaction on the base of P-matrix approach.** Babenko, V.A. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Petrov, N.M. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. HADRON-HADRON INTERACTIONS/inverse scattering problem; HADRON-HADRON INTERACTIONS/scattering amplitudes; INVERSE SCATTERING PROBLEM; MATRICES; SCATTERING

34047 (INIS-RU–347, pp. 363) **Coherent photoproduction of postulated neutral particle in crystals.** Kunashenko, Yu.P. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. 5 refs., 1 fig. POSTULATED PARTICLES/crystals; POSTULATED PARTICLES/photoproduction; COHERENT PRODUCTION; DIFFERENTIAL CROSS SECTIONS; GERMANIUM; MEV RANGE 100-1000; PHOTON BEAMS; CRYSTALS; PHOTOPRODUCTION

34048 (LA-UR–93-2652) **Eta-nucleon interaction and nuclear production of eta mesons.** Liu, L.C. Los Alamos National Lab., NM (United States). [1993]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9305148–1: International conference on meson-nucleus interactions, Crakow (Poland), 14-19 May 1993). Order Number DE93018469. Source: OSTI; NTIS; INIS; GPO Dep.

Eta-nucleon interaction and eta-nucleus dynamics are discussed. The possibility of using η to probe unnatural-parity nuclear states and to study spin-isospin correlations between two nucleons are demonstrated.

34049 (LBL–34241) **The Sudbury Neutrino Observatory and the solar neutrino problem.** Lesko, K.T. For the Collaboration. Lawrence Berkeley Lab., CA (United States). Jan 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-930169–3: 16. nuclear physics symposium, Oaxtepec (Mexico), 5-8 Jan 1993). Order Number DE93018528. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses experiments at the Sudbury Neutrino Observatory on solar neutrino detection.

34050 (LBL–34372) **The Papageno Partonic Monte-Carlo Program.** Hinchliffe, I. Lawrence Berkeley Lab., CA (United States). Jul 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9306176–4: Workshop on physics at current accelerators and the supercollider, Argonne, IL (United States), 2-5 Jun 1993). Order Number DE93018524. Source: OSTI; NTIS; INIS; GPO Dep.

This document provides a brief introduction to the PAPAGENO partonic Monte-Carlo event generator.

34051 (TRI-PP–90-71) **Measurements of NN → dπ near threshold.** Hutcheon, D.A. TRIUMF, Vancouver, BC (Canada). Sep 1990. 9p. (CONF-9009332–: Conference on particle production near threshold, Nashville, IN (United States), 30 Sep - 3 oct 1990). Order Number DE94600374. Source: OSTI; NTIS (US Sales Only); INIS.

New, precise measurements of the differential cross sections for $np \rightarrow d\pi^0$ and $\pi^+ d \rightarrow pp$ and of analyzing powers for $pp \rightarrow d\pi^+$ have been made at energies within 10 MeV (c.m.) of threshold. They allow the pion s-wave and p-wave parts of the production strength to be distinguished unambiguously, yielding an s-wave strength at threshold which is significantly smaller than the previously accepted value. There is no evidence for charge independence breaking nor for πNN resonances near threshold. (Author) (17 refs., 17 figs., tab.).

6624 Properties of Specific Particles and Resonances

Refer also to citation(s) 34011, 34022, 34026, 34035, 34036, 34041, 34042, 34044, 34047, 34048

34052 (DOE/ER/40150–223) **Spin structure functions of the nucleon at low Q^2 and ν.** Burkert, V.D. Southeastern Universities Research Association, Inc., Newport News, VA (United States). Continuous Electron Beam Accelerator Facility. 30 Jun 1993. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84ER40150. (CEBAF-PR–93-031;CONF-930511–243: International particle accelerator conference; 6. international workshop on perspectives in intermediate energy nuclear physics,

Washington, DC (United States); Trieste (Italy), 17-20 May 1993; 4-7 may 1993; CONF-930524 Order Number DE93017454. Source: OSTI; NTIS; INIS; GPO Dep.

Phenomenological approaches to describe the spin structure functions an spin sum rules for proton and neutrons at low momentum transfer Q^2 and energy transfer ν, i.e. in the region of the nucleon resonances are discussed. Experiments to measure A_1^p, A_2^p and N_1^n structure functions at CEBAF in a Q^2 range from 0.15 to 2.0 GeV^2, and a W range from threshold to 2.2 GeV are presented.

34053 (DOE/ER/40704–2-Task-J) **Task J: Outstanding Junior Investigator (OJI): Technical progress report, [November 1, 1993–October 31, 1993].** Karchin, P.E. Yale Univ., New Haven, CT (United States). Dept. of Physics. 6 Jul 1993. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-92ER40704. Order Number DE93018421. Source: OSTI; NTIS; INIS; GPO Dep.

We report on an existing program of research on the production and decay of particles containing the charm and beauty quarks. Charm is studied in Fermilab fixed target experiments E769 and E691. Design and development for a hadron collider beauty experiment is studied in CERN test experiment P238 and in simulation studies for the SSC.

34054 (INIS-RU–347, pp. 99) **Possible manifestation of electrodynamics parameters in nuclear states energies and particle masses.** Sukhoruchkin, S.I. (AN SSSR, Leningrad (Russian Federation). Inst. Yadernoj Fiziki). AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. 4 refs. LAMBDA PARTICLES/mass; NUCLEONS/mass; QUARKS/mass; Z NEUTRAL BOSONS/mass; CORRECTIONS; MASS; MASS DIFFERENCE; NUCLEONS; QUANTUM ELECTRODYNAMICS; QUARKS

34055 (INIS-RU–352, pp. 16-19) **Contribution of even wave function dibaryons to electromagnetic processes.** Akhmedov, D.M.; Fil'kov, L.V. AN SSSR, Moscow (Russian Federation). Fizicheskij Inst. 1991. (In Russian). In *Short communications on physics. Experimental and theoretical physics. No. 6.* 42p. Order Number DE94600073. Source: OSTI; NTIS (US Sales Only); INIS.

The processes involving photons, namely, $\gamma d \rightarrow \gamma pn$, γd, $\pi+\gamma NN$ and $pn \rightarrow \pi+\gamma NN$, were investigated. The contributions of dibaryons $D(T=0,\ J^P=0^\pm)$, $D(0,\ 1^-)$, $D(1,\ 1^\pm)$ with mass $M<2m_N+m_\pi$ (where m_N and m_π are the masses of nucleon and pion respectively) into γd elastic scattering total cross section were calculated. The dibaryons satisfy the condition $(-1)^{T+S}$ P=1 (T is isospin, S is internal spin, P is the dibaryon parity). The $D(0,\ O^\pm)$ contributions into the processes $\gamma d \rightarrow \gamma d$, $\gamma d \rightarrow \gamma pn$ are very large: in the point M=2 GeV they are greater than the cross section of corresponding processes near resonance by the factor approximately equal 10^4. The cross sections of dibaryon production in the process $pn \rightarrow \pi^0 + \gamma pn$ were evaluated. The conclusion is made that the study into the processes $\gamma d \rightarrow \pi+\gamma NN$; $\gamma d \rightarrow \pi+NN$, $pn \rightarrow \pi+\gamma NN$ may give the information on the possibility of existence of dibaryons $D(1,\ 1^\pm)$, and the study into the processes $\gamma d \rightarrow \gamma d$, $\gamma d \rightarrow \gamma pn$ provides for revealing the existence of dibaryons $D(0,\ 0^\pm)$.

34056 (LA-UR–93-2644) **T violating neutron spin rotation asymmetry.** Masuda, Yasushiro. Los Alamos National Lab., NM (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9305235–3: International workshop/time reversal invariance and parity violation in neutron physics, Dubna (Russian Federation), 4-7 May 1993). Order Number DE93018470. Source: OSTI; NTIS; INIS; GPO Dep.

A new experiment on T-violation is proposed, where a spin-rotating-neutron transmission through a polarized nuclear target is measuered. The method to control the neutron spin is discussed for the new T-violation experiment. The present method has possibility to provide us more accurate T-violation information than the neutron EDM measurement.

34057 (LA-UR–93-2659) **Neutrino mass, a status report.** Robertson, R.G.H. Los Alamos National Lab., NM (United States). [1993]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9307114–1: 14. international workshop on weak interactions and neutrinos, Seoul (Korea, Republic of), 19-24 Jul 1993). Order Number DE93018467. Source: OSTI; NTIS; INIS; GPO Dep.

Experimental approaches to neutrino mass include kinematic mass measurements, neutrino oscillation searches at rectors and accelerators, solar neutrinos, atmospheric neutrinos, and single and double beta decay. The solar neutrino results yield fairly strong and consistent indications that neutrino oscillations are occurring. Other evidence for new physics is less consistent and convincing.

34058 (LBL–34313) **Physics motivations for SSC/LHC detectors.** Hinchliffe, I. Lawrence Berkeley Lab., CA (United States). Jun 1993. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-9306176–5: Workshop on physics at current accelerators and the supercollider, Argonne, IL (United States), 2-5 Jun 1993). Order Number DE93019230. Source: OSTI; NTIS; INIS; GPO Dep.

In this talk, I review the some of the physics goals and simulation work done in the SSC and LHC experimental proposal. I select the processes that illustrate the strengths and weaknesses the proposed detectors.

6630 Nuclear Physics

34059 (CNIC–00530, pp. 3-13) **Nuclear data progress in China (1987 ≈ 1990).** Cai Dunjiu (Chinese Nuclear Data Center, Beijing, BJ (China)); Yuan Hanrong. Chinese Nuclear Data Center, Beijing, BJ (China); China Nuclear Information Centre, Beijing, BJ (China). Jun 1991. (CNDC–0006;INDC(CPR)–022/L.). In *Communication of nuclear data progress: No.5 (1991).* 77p. Order Number DE93633161. Source: OSTI; NTIS (US Sales Only); INIS.

The nuclear data progress from 1987 to 1990 in China were described. It includes nuclear data evaluations and nuclear data library development, development of theory method and code used for nuclear data calculation and evaluation, group constant generating and benchmark testing, nuclear data measurement; international activities and co-operations. These works were carried out by the Chinese Nuclear Data Center and the chinese Nuclear Data Coordination Network.

34060 (DOE/ER–0590) **Summaries of FY 1992 research in nuclear physics.** USDOE Office of Energy Research, Washington, DC (United States). Nuclear Physics Div. Jul 1993. 286p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93017934. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the research projects supported by the Division of Nuclear Physics in the Office of High Energy and Nuclear Physics during FY 1992. This Division is a component of the Office of Energy Research and provides about 85% of the funding for nuclear physics research in the United States. The objectives of the Nuclear Physics Program are two-fold: (1) to understand the interactions and structures of atomic nuclei and nuclear matter and the fundamental forces of nature as manifested in nuclear matter and (2) to foster application of this knowledge to other sciences and technical disciplines. These summaries are intended to provide a convenient guide for those interested in the research supported by the Division of Nuclear Physics. We remind the readers that this compilation is just an overview of the Nuclear Physics Program. What we attempt to portray correctly is the breadth of the program and level of activity in the field of nuclear physics research as well as the new capabilities and directions that continually alter the public face of the nuclear sciences. We hope that the limitations of space, constraints of fon-nat, and rigors of editing have not extinguished the excitement of the science as it was originally portrayed.

34061 (DOE/ER/40285–6) **A program in medium-energy nuclear physics: Progress report, August 1, 1991–August 31,**

1992. Berman, B.L.; Dhuga, K.S. George Washington Univ., Washington, DC (United States). Dept. of Physics. [1992]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-86ER40285. Order Number DE93018145. Source: OSTI; NTIS; INIS; GPO Dep.

This report reviews progress on our nuclear-physics program for the last year, and includes as well copies of our publications and other reports for that time period. The structure of this report follows that of our 1991 Renewal Proposal and Progress Report: Sec. II outlines our research activities aimed at future experiments at CEBAF, NIKHEF, and Bates; Sec. III gives results of our recent research activities at NIKHEF, LAMPF, and elsewhere; Sec. IV provides an update of our laboratory activities at GWU, including the acquisition of our new Nuclear Detector Laboratory at our new Virginia Campus; and Sec. V is a list of our publications, proposals, and other reports. copies of those on medium-energy nuclear physics are reproduced in the Appendix.

34062 (DOE/ER/40285–T2) **A program in medium-energy nuclear physics: Progress report, September 1, 1992–June 30, 1993.** Berman, B.L.; Dhuga, K.S. George Washington Univ., Washington, DC (United States). Dept. of Physics. [1993]. 20p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-86ER40285. Order Number DE93018137. Source: OSTI; NTIS; INIS; GPO Dep.

This report reviews progress on our nuclear-physics program for the last ten months, and includes as well copies of our publications and other reports for that time period. The structure of this report follows that of our 1992 Progress Report: Sec. II outlines our research activities aimed at future experiments at CEBAF, NIKHEF, and Bates; Sec. III gives results of our recent research activities at NIKHEF, LAMPF, and elsewhere; Sec. IV provides an update of our laboratory activities at GWU, including those at our new Nuclear Detector Laboratory at our Virginia Campus; and Sec. V is a list of our publications, proposals, and other reports. Copies of those on medium-energy nuclear physics are reproduced in the Appendix. The highlight of the year has been the approval by the NIKHEF and CEBAF PACs of all three of the proposals we have submitted. These are "Recoil Polarization of the Neutron in the Reactions ^{3}He(e,e′n) and ^{4}He(e,e′n)," NIKHEF Proposal 93-09, "Photoreactions on ^{3}He," CEBAF Proposal 93-044, and "Photoabsorption and Photofission of Nuclei," CEBAF Proposal 93-019. The NIKHEF experiment involves the use of the High-Acceptance Recoil Polarimeter for detection and measurement of the polarization of the emitted neutron. We, together with our colleagues at Grenoble, are responsible for the design and construction of the wire chambers for this device; we have largely completed the design phase this past year. The CEBAF experiments involve the use of the Hall-B Photon Tagger for production of the monochromatic photon beam. We are responsible for the 432-scintillator focal-plane detector array for this device; again, most of the design work and some prototype testing have been completed this past year. In addition, we have continued to make progress on data analysis and publication of results of previous measurements at Bates, LAMPF, and NIKHEF.

34063 (DOE/ER/40561–110-INT93) **Institute for Nuclear Theory: Annual report No. 3, 1 March 1992–28 February 1993.** Haxton, W.; Bertsch, G.; Henley, E.M. Washington Univ., Seattle, WA (United States). [1993]. 155p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG06-90ER40561. Order Number DE93017369. Source: OSTI; NTIS; INIS; GPO Dep.

This report briefly discussion the following programs of the Institute for Nuclear Theory: fundamental interactions in nuclei; strangeness in hadrons and nuclei; microscopic nuclear structure theory; nuclear physics in atoms and molecules; phenomenology and lattice QCD; and large amplitude collective motion.

6631 Nuclear Structure

Refer also to citation(s) 34190, 34191, 34224, 34264, 34273, 34337, 34342, 34343

34064 (BNL–49079) **A new simple global phenomenology of nuclear shape transitions.** Casten, R.F. (Brookhaven National Lab., Upton, NY (United States)); Zamfir, N.V.; Brenner, D.S. Brookhaven National Lab., Upton, NY (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016 ;FG02-88ER40417. (CONF-930534–2: 3. international conference on radioactive nuclear beams, East Lansing, MI (United States), 24-27 May 1993). Order Number DE93017577. Source: OSTI; NTIS; INIS; GPO Dep.

The energies of low-spin yrast states, $E(4_1^+)$, and the transition probabilities, $B(E2; 2_1^+ \rightarrow 0_1^+)$, that are among the most revealing and the easiest to measure observables of collectivity, show remarkable global correlations that change our understanding of nuclear structure and nuclear phase transitions and provide new signatures to identify particular structures. These signatures will be particularly valuable in the era of radioactive beams when the quantity of information available in newly-observed nuclei will be radically reduced compared to what we are accustomed to.

34065 (BNL–70084) **Travel to Germany to conduct research in nuclear physics and nuclear structure: Foreign trip report, October 29–December 22, 1991.** Casten, R.F. Brookhaven National Lab., Upton, NY (United States). 13 Jan 1992. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE93018255. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A number of basic research projects were carried out or initiated during this trip. Some of these focused on effective charges in valence models, a new region of O(6)-like nuclei, an extensive set of non-contiguous nuclei with identical rotational bands, signature splitting in negative parity states, an analysis of ^{114}Cd lifetime data, and some intriguing phenomenology in plots of $E(2_1^+)$ versus P.

34066 (DOE/ER/40270–42) **Investigations of the structure and electromagnetic interactions of few-body systems: Progress report, 1 July 1992–30 June 1993.** Lehman, D.R.; Haberzettl, H.; Maximon, L.C.; Parke, W.C.; Bennhold, C.; Ito, Hiroshi; Pratt, R.K.; Najmeddine, M.; Rakei, A. George Washington Univ., Washington, DC (United States). Center for Nuclear Studies. Jul 1993. 53p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-86ER40270. Order Number DE93019596. Source: OSTI; NTIS; INIS; GPO Dep.

The emphasis of the nuclear theory group has been on the structure and electromagnetic interactions of few-body nuclei. Both low- and intermediate-energy electromagnetic disintegration of these nuclei is considered, including coherent photoproduction of π mesons. When the excitation energy of the target nucleus is low, the aim is to handle the continuum part of the theoretical work numerically with no approximations, that is, by means of full three- or four-body dynamics. When structure questions are the issue, numerically accurate calculations are always carried through, limited only by the underlying two-body or three-body interactions used as input. A central goal is to carry through state-of-the-art few-body calculations that will serve as a means of determining at what point standard nuclear physics requires introduction of relativity and/or quark degrees of freedom in order to understand the phenomena in question.

34067 (INIS-RU–347, pp. 41) **Stabilizing shell effect and unified character of its parameters.** Sukhoruchkin, S.I. (AN SSSR, Leningrad (Russian Federation). Inst. Yadernoj Fiziki). AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. 2 refs. LIGHT NUCLEI/excited states; EVEN-EVEN NUCLEI; SHELL MODELS

34068 (INIS-RU–347, pp. 42) **Occupation of ^{27}Al levels in the (n,n′γ) reaction.** Kosyak, Yu.G. (AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki); Lysikov, Yu.A.; Urikbaeva, G.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear

spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. 3 refs., 1 tab. ALUMINIUM 27/energy levels; ALUMINIUM 27 TARGET; EXPERIMENTAL DATA; FAST NEUTRONS; INELASTIC SCATTERING; NEUTRON REACTIONS; OCCUPATION NUMBER; STATISTICAL MODELS; THEORETICAL DATA

34069 (INIS-RU–347, pp. 45) **New magic numbers in the atomic nucleus.** Burmistrov, V.R. (AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki). AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. MAGIC NUCLEI/atomic number; MAGIC NUCLEI/mass number; CLUSTER MODEL; NEUTRONS; PROTONS

34070 (INIS-RU–347, pp. 52) **High spin states of ^{86}Sr.** Erokhina, K.I.; Zobov, A.E.; Isakov, V.I.; Lemberg, I.Kh. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs., 1 fig. STRONTIUM 86/high spin states; DEUTERON REACTIONS; HELIUM 3 REACTIONS; RANDOM PHASE APPROXIMATION

34071 (INIS-RU–347, pp. 53) **High spin states of ^{92}Mo.** Zobov, A.E.; Mishin, A.S.; Chugunov, I.N. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref., 1 tab. MOLYBDENUM 92/high spin states; ANGULAR DISTRIBUTION; ENERGY-LEVEL TRANSITIONS; EXPERIMENTAL DATA; GAMMA RADIATION

34072 (INIS-RU–347, pp. 55) **Decay scheme of ^{93}Mo.** Zobov, A.E.; Mishin, A.S.; Izotov, A.L. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs., 1 tab. MOLYBDENUM 93/excited states; ANGULAR DISTRIBUTION; ENERGY-LEVEL TRANSITIONS; EXPERIMENTAL DATA; ISOMERIC NUCLEI; SELENIUM 80 TARGET

34073 (INIS-RU–347, pp. 56) **Excited state scheme of ^{96}Rh.** Vinogradov, V.M.; Sergeev, V.O.; Sitnikova, I.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. RHODIUM 96/excited states; EXPERIMENTAL DATA; MEV RANGE 01-10; PROTON REACTIONS; Q-VALUE; RUTHENIUM 96 TARGET

34074 (INIS-RU–347, pp. 59) **Determination of correcting slowing-down factors of Ru in Mo for the alpha reactions.** Kudoyarov, M.F. (AN SSSR, Leningrad (Russian Federation). Fiziko-Tekhnicheskij Inst.); Kuz'min, E.V.; Pasternak, A.A.; Gonusek, M.; Shpalek, A.; Adam, I.; Kult, K. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs., 1 fig. RUTHENIUM 102/excited states; ALPHA REACTIONS; CORRECTIONS; LIFETIME; MOLYBDENUM 100 TARGET; SLOWING-DOWN

34075 (INIS-RU–347, pp. 60) **Lifetime measurement of ^{102}Ru levels by the dsa method.** Kudoyarov, M.F. (AN SSSR, Leningrad (Russian Federation). Fiziko-Tekhnicheskij Inst.); Kuz'min, E.V.; Pasternak, A.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 5 refs., 1 tab. RUTHENIUM 102/excited states; ALPHA REACTIONS; DSA METHOD; EXPERIMENTAL DATA; LIFETIME; MOLYBDENUM 100 TARGET

34076 (INIS-RU–347, pp. 61) **Selected intervals in distribution of high-excited nuclear level distances (2).** Sukhoruchkin, S.I. (AN SSSR, Leningrad (Russian Federation). Inst. Yadernoj Fiziki). AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. EVEN-ODD NUCLEI/excited states; CADMIUM ISOTOPES; ENERGY-LEVEL DENSITY; HAFNIUM ISOTOPES

34077 (INIS-RU–347, pp. 62) **Occupation of ^{114}Te levels in the alpha reactions.** Kovrigin, O.D. (AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki); Koval'chuk, K.V.; Lysikov, Yu.A.; Arynov, S. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs., 1 tab. TELLURIUM 114/excited states; ALPHA REACTIONS; ENERGY DEPENDENCE; EXPERIMENTAL DATA; OCCUPATION NUMBER; SPIN; TIN 112 TARGET

34078 (INIS-RU–347, pp. 63) **Lifetime measurements in quasirotational bands of ^{116,118}Sn states.** Kudoyarov, M.F. (AN SSSR, Leningrad (Russian Federation). Fiziko-Tekhnicheskij Inst.); Kuz'min, E.V.; Pasternak, A.A.; Lobach, Yu.N. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata

(Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs., 1 tab. TIN 116/rotational states; TIN 118/rotational states; EXPERIMENTAL DATA; E2-TRANSITIONS; LIFETIME; PROBABILITY

34079 (INIS-RU–347, pp. 67) **Neutron-rich nuclei in a magic region near ^{132}Sn.** Erokhina, K.I.; Isakov, V.I. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref., 1 tab. NEUTRON-RICH ISOTOPES/magic nuclei; EXPERIMENTAL DATA; E2-TRANSITIONS; M1-TRANSITIONS; THEORETICAL DATA; TIN 130; TIN 132

34080 (INIS-RU–347, pp. 70) **Investigation of ^{142}Ce in the (n,n'γ) reaction.** Al'khamidi, M.M.; Demidov, A.M.; Dyufani, M.M.; Elarash, M.S.; Zlitni, S.M.; Kurkin, V.A.; Mikhajlov, I.V.; Rateb, Dzh.M.; Sergiva, S.M.; Shermit, A.M. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref., 1 tab. CERIUM 142/excited states; EXPERIMENTAL DATA; FAST NEUTRONS; NEUTRON REACTIONS

34081 (INIS-RU–347, pp. 73) **Magnetic dipole moments of the ^{147,149}Gd ground states.** Kratsikova, T.I. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Davaa, S.; Finger, M.; Slunechka, M.; Slovak, Ya.; Tetgal, T. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs., 1 tab. GADOLINIUM 147/ground states; GADOLINIUM 149/ground states; EXPERIMENTAL DATA; MAGNETIC DIPOLE MOMENTS; ORIENTATION

34082 (INIS-RU–347, pp. 83) **Magnetic properties of rotational band in ^{159}Tb.** Grigor'ev, E.P.; Slesarchuk, E.B. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs., 1 fig. TERBIUM 159/rotational states; E2-TRANSITIONS; GROUND STATES; M1-TRANSITIONS; NUCLEAR MAGNETIC MOMENTS; SPIN; THEORETICAL DATA

34083 (INIS-RU–347, pp. 84) **^{162}Dy studied with the (d,p), (d,t), (n,γ) and (n,n'γ) reactions.** Berzins, J. (AN Latvijskoj SSR, Riga (Latvia). Inst. Fiziki); Ganko, M.; Prokofjev, P.T. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. 2 refs., 1 tab. DYSPROSIUM 162/excited states; DEUTERON REACTIONS; DYSPROSIUM 161 TARGET; DYSPROSIUM 163 TARGET; EXPERIMENTAL DATA; GAMMA RADIATION; KEV RANGE; MEV RANGE 10-100; NEUTRON REACTIONS; NEUTRONS; PARITY; PROTONS; SPIN; TRITIUM

34084 (INIS-RU–347, pp. 85) **The quadrupole and octupole excitations of ^{162,164}Dy.** Afanasjev, A. (AN Latvijskoj SSR, Riga (Latvia). Inst. Fiziki); Tambergs, J.; Berzins, J. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. 1 ref., 1 tab. DYSPROSIUM 162/rotational states; DYSPROSIUM 164/rotational states; EXPERIMENTAL DATA; PARITY; SPIN; THEORETICAL DATA

34085 (INIS-RU–347, pp. 86-87) **Investigation of gamma transitions populating the 1094 keV isomeric state in the ^{167}Er(n,γ) reaction.** Bogdanovic, M.; Simic, J. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs., 1 tab. ERBIUM 168/excited states; ENERGY-LEVEL TRANSITIONS; ERBIUM 167 TARGET; EXPERIMENTAL DATA; GAMMA RADIATION; ISOMERIC NUCLEI; NEUTRON REACTIONS; OCCUPATION NUMBER

34086 (INIS-RU–347, pp. 94-95) **Microscopic description of properties of ^{177}Hf low-lying states.** Alikov, B.A. (Tashkentskij Gosudarstvennyj Univ., Tashkent (Uzbekistan)); Muminov, T.M. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. 4 refs., 1 tab. HAFNIUM 177/excited states; HAFNIUM 177/e1-transitions; GAMMA RADIATION; E1-TRANSITIONS; NUCLEAR MODELS; PARITY; PROBABILITY; SPIN; THEORETICAL DATA; TRANSITION AMPLITUDES

34087 (INIS-RU–347, pp. 100) **New band with $K^{\pi}=1^{-}$ band on 1513.900 keV level in ^{178}Hf.** Grigor'ev, E.P. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. 1 ref. HAFNIUM 178/multipole transitions; HAFNIUM 178/rotational states; BETA DECAY; FT VALUE; ISOMERIC NUCLEI; LUTETIUM 178; PARITY; PROBABILITY; SPIN; TANTALUM 178

34088 (INIS-RU–347, pp. 105) **Rotational interpretation of ^{192}Ir.** Balodis, M. (AN Latvijskoj SSR, Riga (Latvia). Inst. Fiziki). AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. 4 refs., 2 tabs. IRIDIUM 192/excited states; NILSSON-MOTTELSON MODEL; PARITY; SPIN; THEORETICAL DATA

34089 (INIS-RU–347, pp. 106-107) **Rotational interpretation of ^{194}Ir.** Balodis, M. (AN Latvijskoj SSR, Riga (Latvia). Inst. Fiziki); Berzins, J.; Kramer, N.; Prokofjev, P.; Kern, J.; Edigy, T. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 7 refs., 1 tab. IRIDIUM 194/excited states; DEUTERON REACTIONS; EXPERIMENTAL DATA; GAMMA RADIATION; NEUTRON REACTIONS; PARITY; PROTONS; SPIN; THERMAL NEUTRONS

34090 (INIS-RU–347, pp. 109) **Mean-square radii and quadrupole moments of uranium isotopes.** Kuprikov, V.I. (AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst.); Soznik, A.P.; Tarasov, V.N. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs., 1 tab. URANIUM ISOTOPES/nuclear radii; URANIUM ISOTOPES/quadrupole moments; EXPERIMENTAL DATA; HARTREE-FOCK METHOD; MASS NUMBER

34091 (INIS-RU–347, pp. 112) **Unified approach to description of the nuclear dynamics and properties of the ground state.** Khodel', V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (Russian Federation). Inst. Atomnoj Ehnergii); Shaginyan, V.R. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 ref. NUCLEAR MATTER/collective excitations; NUCLEAR MATTER/ground states; CORRELATIONS; NEUTRONS

34092 (INIS-RU–347, pp. 113) **Selection rules in isospin and the widths of high-excited states for light nuclei.** Zhusupov, M.A.; Usmanov, T.G. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs. LIGHT NUCLEI/excited states; ISOSPIN; LEVEL WIDTHS; NUCLEAR DECAY; NUCLEONS; SELECTION RULES; SHELL MODELS

34093 (INIS-RU–347, pp. 114) **Role of nuclear relativism in calculations of magnetic form factors.** Kasymbalinov, R.N. (AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki). AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. EVEN-ODD NUCLEI/electromagnetic form factors; ODD-EVEN NUCLEI/electromagnetic form factors; DIRAC EQUATION; ENERGY LEVELS; NUCLEONS; RELATIVISTIC RANGE; WOODS-SAXON POTENTIAL

34094 (INIS-RU–347, pp. 115) **Microscopic description of the halo effect.** Gorbatov, A.M. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. NUCLEAR REACTIONS/cluster model; BOUND STATE; THRESHOLD ENERGY; WAVE FUNCTIONS

34095 (INIS-RU–347, pp. 116) **Wave function structure of the ^{6}He and ^{11}Li nuclei.** Gorbatov, A.M.; Kolganova, E.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. LITHIUM 11/wave functions; LITHIUM 6/wave functions; HYPERGEOMETRIC FUNCTIONS; NUCLEAR MATTER

34096 (INIS-RU–347, pp. 117) **Microscopic approach of point-mass density distribution of the ^{4}He nucleus.** Gorbatov, A.M.; Kolganova, E.A.; Komarov, P.V.; Nikishov, P.Yu.; Bursak, A.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. HELIUM 4/wave functions; NUCLEAR MATTER

34097 (INIS-RU–347, pp. 118) **Soft dipole resonance in ^{11}Li in three-particle cluster model with continuous spectrum.** Lur'e, Yu.A. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Smirnov, Yu.F.; Shirokov, A.M. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 4 refs. LITHIUM 11/excited states; CLUSTER MODEL; E1-TRANSITIONS; HEAVY NUCLEI; LITHIUM 11 REACTIONS; STRENGTH FUNCTIONS; SUM RULES; WAVE FUNCTIONS

34098 (INIS-RU–347, pp. 121) **Microscopic derivation of the collective Hamiltonian for quadrupole vibrations of even-even nuclei.** Vorov, O.K. (AN SSSR, Novosibirsk (Russian Federation). Inst. Yadernoj Fiziki). AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. EVEN-EVEN NUCLEI/excited states; COLLECTIVE MODEL; HAMILTONIANS

34099 (INIS-RU–347, pp. 122) **Linear relations between masses and Coulomb-energy differences of terms of isobaric multiplets.** Poplavskij, I.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. ISOBARIC NUCLEI/multiplets; COULOMB ENERGY; MULTIPLETS; ISOSPIN; MASS FORMULAE; RECURSION RELATIONS

34100 (INIS-RU–347, pp. 123) **Recursion mass formula for heavy even-even isotopes.** Poplavskij, I.V.; Popushoj, M.N. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs., 1 tab. HEAVY NUCLEI/mass formulae; CALIFORNIUM 240; CURIUM 236; FERMIUM 244; MASS; PLUTONIUM 230; POLONIUM 220; RADIUM 230; RADON 224; THEORETICAL DATA; THORIUM 236; URANIUM ISOTOPES; URANIUM 242

34101 (INIS-RU–347, pp. 125) **Spectra of the ^{9}Be and ^{9}B nuclei in the three-particle multicluster model.** Razikov, Kh.D. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. BERYLLIUM 9/energy levels; BORON 9/energy levels; ALPHA PARTICLES; CLUSTER MODEL; NUCLEONS; THREE-BODY PROBLEM

34102 (INIS-RU–347, pp. 126) **Construction of the effective NN-potential on data for the light, intermediate and heavy nuclei.** Simenog, I.V.; Steshenko, A.I. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 tab. MAGIC NUCLEI/nucleon-nucleon potential; CALCIUM 40; D STATES; HELIUM 4; OXYGEN 16; ROTATIONAL STATES; S STATES

34103 (INIS-RU–347, pp. 127) **Description of properties of finite final nuclei and nucleon-nucleus potentials on the base of NN potentials of the mesonic theory.** Pozdnyakov, A.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 5 refs. INTERMEDIATE MASS NUCLEI/binding energy; INTERMEDIATE MASS NUCLEI/nuclear radii; LEAD 208; NUCLEON-NUCLEON POTENTIAL; OBE MODEL

34104 (INIS-RU–347, pp. 128) **Description of properties of the neutron-rich nuclei in the hyperspherical function method.** Galakhmatova, B.S. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Kamchatnova, V.A.; Chernyaev, A.P.; Shitikova, K.V.; Yudin, S.N. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs., 1 tab. NEUTRON-RICH ISOTOPES/form factors; BINDING ENERGY; EXPERIMENTAL DATA; HYPERGEOMETRIC FUNCTIONS; LITHIUM 10; LITHIUM 11; LITHIUM 6; LITHIUM 7; LITHIUM 8; LITHIUM 9; NUCLEAR RADII

34105 (INIS-RU–347, pp. 130) **M4-excitations of ^{10}B.** Arakelyan, Eh.R. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation)); Goncharova, N.G. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 tabs. BORON 10/excited states; BORON 10/m4-transitions; M4-TRANSITIONS; ENERGY DEPENDENCE; FORM FACTORS; ISOVECTORS; PARITY; SPIN; THEORETICAL DATA

34106 (INIS-RU–347, pp. 131) **Isoscalar dipole states and the ^{18}O nucleus polarizability.** Gul'karov, I.S.; Karimov, M.G.; Nigmankhodzhaev, A.G. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs., 1 tab. OXYGEN 18/excited states; OXYGEN 18/e1-transitions; CHARGE DENSITY; LEVEL WIDTHS; E1-TRANSITIONS; PARITY; POLARIZABILITY; PROBABILITY; SPIN; THEORETICAL DATA

34107 (INIS-RU–347, pp. 132) **Explicit nuclear collective potential expression in the powers of elementary invariants.** Katkevicius, O. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 4 refs. COLLECTIVE MODEL/two-body problem; INVARIANCE PRINCIPLES; NUCLEAR POTENTIAL; NUCLEAR THEORY; NUCLEON-NUCLEON POTENTIAL

34108 (INIS-RU–347, pp. 133) **Vectorial interaction in the strictly restricted dynamics model.** Ruza, J. (AN Latvijskoj SSR, Riga (Latvia). Inst. Fiziki); Guseva, T.; Tambergs, J.; Alkaras, J.A.; Katkevicius, O. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs., 1 tab. MIRROR NUCLEI/excited states; NUCLEON-NUCLEON POTENTIAL; THEORETICAL DATA

34109 (INIS-RU–347, pp. 134) **SU_3 band mixing effects in the framework of strictly restricted dynamics model.** Katkevicius, O.; Ruza, J.; Guseva, T.; Tambergs, J.; Alcaras, J.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref., 1 tab. MAGNESIUM 24/excited states; SULFUR 32/excited states; ELLIOT MODEL; GAMMA RADIATION; SU-3 GROUPS; TRANSITION AMPLITUDES

34110 (INIS-RU–347, pp. 136) **Effective account of hexadecupole modes in the nuclear collective model with dynamical quadrupole deformations.** Porodzinskij, Yu.V.; Sukhovitskij, E.Sh. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. COLLECTIVE MODEL/nuclear deformation; ROTATIONAL STATES; VIBRATIONAL STATES

34111 (INIS-RU–347, pp. 137) **Rotational-vibrational excited states of deformed even-even nuclei.** Sharipov, Sh. (AN Uzbekskoj SSR, Tashkent (Uzbekistan). Inst. Yadernoj Fiziki); Nadyrbekov, M.S. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. EVEN-EVEN NUCLEI/rotational states; EVEN-EVEN NUCLEI/vibrational states; DEFORMED NUCLEI

34112 (INIS-RU–347, pp. 138) **Proton-neutron interactions and masses of nuclei with Z>N.** Avotina, M.P.; Lemberg, I.Kh. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. INTERMEDIATE MASS NUCLEI/mass; LIGHT NUCLEI/mass; MASS; MIRROR NUCLEI

34113 (INIS-RU–347, pp. 141) **Microscopic description of giant resonance widths in magic nuclei.** Kamerdzhiev, S.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (Russian Federation). Fiziko-Ehnergeticheskij Inst.); Tertychnyj, G.Ya. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. MAGIC NUCLEI/giant resonance; CALCIUM 40; CALCIUM 48; ENERGY LEVELS; E0-TRANSITIONS; E2-TRANSITIONS; LEAD 208; LEVEL WIDTHS

34114 (INIS-RU–347, pp. 142) **Hartree-Fock potential of nuclear matter.** Kadmenskij, S.G.; Luk'yanovich, P.A.; Lyuboshits, V.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 4 refs. NUCLEAR MATTER/nuclear potential; EFFECTIVE MASS; HARTREE-FOCK METHOD; NUCLEON-NUCLEON POTENTIAL; NUCLEONS

34115 (INIS-RU–347, pp. 143) **Self-consistent potential of atomic nuclei and fragmentation effects.** Kadmenskij, S.G.; Luk'yanovich, P.A.; Lyuboshits, V.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs. HEAVY NUCLEI/excited states; CORRELATIONS; HARTREE-FOCK METHOD; NUCLEAR POTENTIAL; OPTICAL MODELS; PARTICLE-HOLE MODEL; RESIDUAL INTERACTIONS; SPECTROSCOPIC FACTORS

34116 (INIS-RU–347, pp. 144) **Distribution of octupole force in deformed nuclei up to 6 MeV energy.** Solov'ev, V.G. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Sushkov, A.V.; Shirikova, N.Yu. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs. EVEN-EVEN NUCLEI/deformed nuclei; EVEN-EVEN NUCLEI/e3-transitions; COLLECTIVE MODEL; E3-TRANSITIONS; EXCITED STATES; GADOLINIUM 158; QUASIPARTICLE-PHONON MODEL; STRENGTH FUNCTIONS; WAVE FUNCTIONS

34117 (INIS-RU–347, pp. 145) **Stochastic approach to description of nuclear collective motion.** Kolomiets, V.M. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Kondrat'ev, V.N. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 ref. NUCLEI/collective model; NUCLEI/cranking model; DISSIPATION FACTOR; ENERGY-LEVEL DENSITY; MATRIX ELEMENTS; NUCLEAR TEMPERATURE; NUCLEI; RELAXATION TIME

34118 (INIS-RU–347, pp. 146) **Attenuation of nuclear zerosound as a delayed effect in kinetic equation.** Kolomiets, V.M. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Magner, A.G.; Plyujko, V.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 ref. NUCLEAR MATTER/collision integrals; NUCLEAR MATTER/zero sound; COLLECTIVE EXCITATIONS; GREEN FUNCTION; KINETIC EQUATIONS; LANDAU DAMPING; NUCLEAR TEMPERATURE; VISCOSITY

34119 (INIS-RU–347, pp. 147) **Fermi surface deformation at giant monopole resonance.** Abrosimov, V.I. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Toro, M. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs. HEAVY NUCLEI/nuclear deformation; INTERMEDIATE MASS NUCLEI/nuclear deformation; BOLTZMANN-VLASOV EQUATION; COLLECTIVE MODEL; COLLISION INTEGRALS; FERMI LEVEL; GIANT RESONANCE

34120 (INIS-RU–347, pp. 148) **Vibrational states effect on thermodynamic characteristics of heated nuclei.** Ezhov, S.N. (Kievskij Gosudarstvennyj Univ., Kiev (Ukraine)); Plyujko, V.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs. THERMODYNAMIC MODEL/equations of state; THERMODYNAMIC MODEL/vibrational states; COLLECTIVE MODEL; ENERGY-LEVEL DENSITY; IRON 56; NUCLEAR POTENTIAL; NUCLEAR TEMPERATURE; NUCLEI

34121 (INIS-RU–347, pp. 149) **Consistent calculation of polarized electric dipole moment by shell correction method.** Denisov, V.Yu. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij). AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 4 refs. BARIUM ISOTOPES/electric dipole moments; BARIUM ISOTOPES/shell models; RADIUM ISOTOPES/electric dipole moments; RADIUM ISOTOPES/shell models; THORIUM ISOTOPES/electric dipole moments; THORIUM ISOTOPES/shell models; CORRECTIONS; NUCLEAR DEFORMATION; NUCLEAR STRUCTURE

34122 (INIS-RU–347, pp. 150) **Direct nucleon decay of giant resonances.** Murav'ev, S.E. (Moskovskij Inzhenerno-Fizicheskij Inst., Moscow (Russian Federation)); Urin, M.G. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 3 refs. GIANT RESONANCE/nucleon reactions; GIANT RESONANCE/random phase approximation; LEAD 208 TARGET; LEVEL WIDTHS; S MATRIX; SCATTERING

34123 (INIS-RU–347, pp. 151) **Change of quasiparticle vacuum properties in aligned multiphonon bands.** Vlasnikov, A.K. (Leningradskij Gosudarstvennyj Univ., Leningrad (Russian Federation)); Mikhajlov, V.M. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 ref., 1 tab. LIGHT NUCLEI/e2-transitions; LIGHT NUCLEI/phonons; HAMILTONIANS; E2-TRANSITIONS; PHONONS; MATRIX ELEMENTS; PARTICLE-HOLE MODEL; PROBABILITY; SPIN; THEORETICAL DATA; VACUUM STATES

34124 (INIS-RU–347, pp. 152) **Temperature-dependent 'surface tension' in the ideal Fermi gas model.** Barabanov, A.L. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 3 refs. FERMI GAS MODEL/surface tension; ARGON 40 REACTIONS; FISSION FRAGMENTS; MEV RANGE 100-1000; MULTIPLE PRODUCTION; NEUTRONS; NUCLEAR TEMPERATURE; URANIUM 238 TARGET

34125 (INIS-RU–347, pp. 153) **Two-quasiparticle spectra in the range of $_{50}{}^{132}Sn_{82}$.** Artamonov, S.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 3 refs. ANTIMONY ISOTOPES/excited states; CADMIUM 130/excited states; INDIUM ISOTOPES/excited states; TELLURIUM 134/excited states; TIN 130/excited states; TIN 134/excited states; MAGIC NUCLEI; RANDOM PHASE APPROXIMATION; SPHERICAL MODEL; WAVE FUNCTIONS; WOODS-SAXON POTENTIAL

34126 (INIS-RU–347, pp. 154) **Effective Hamiltonian of interaction of quasiparticles with core quadrupole excitations.** Dojnikov, D.N.; Mikhajlov, V.M. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs., 1 tab. INTERACTING BOSON MODEL/hamiltonians; SELENIUM 77/excited states; SELENIUM 79/excited states; BOSONS; FERMIONS; HAMILTONIANS; QUASI PARTICLES; SPIN; TAMM-DANCOFF METHOD; THEORETICAL DATA

34127 (INIS-RU–347, pp. 155) **Momentum distribution of nucleons and clusters in atomic nuclei.** Kadmenskij, V.G.; Kadmenskij, S.G. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear*

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Short communication. 1 ref. INTERMEDIATE MASS NUCLEI/cluster model; INTERMEDIATE MASS NUCLEI/nucleons; CORRELATIONS; DISTRIBUTION FUNCTIONS; FORM FACTORS; NUCLEONS; LINEAR MOMENTUM OPERATORS; MASS NUMBER; OCCUPATION NUMBER

34128 (INIS-RU–347, pp. 156) **Variable moment of inertia model for description of odd nuclei rotation.** Mitropol'skij, I.A. (AN SSSR, Leningrad (Russian Federation). Inst. Yadernoj Fiziki); Narizhneva, N.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 tab. DEFORMED NUCLEI/rotational states; DEFORMED NUCLEI/vmi model; EVEN-ODD NUCLEI; HOLMIUM 161; MOMENT OF INERTIA; ODD-EVEN NUCLEI; SPIN; THEORETICAL DATA

34129 (INIS-RU–347, pp. 157) **On self-consistent approaches to IAR theory.** Rumyantsev, O.A. (Moskovskij Inzhenerno-Fizicheskij Inst., Moscow (Russian Federation)); Urin, M.G. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 3 refs. INTERMEDIATE MASS NUCLEI/isobaric analogs; BREIT-WIGNER FORMULA; ISOSPIN; LEVEL WIDTHS; NUCLEAR DECAY; PROTON REACTIONS; RANDOM PHASE APPROXIMATION; RESONANCE; S MATRIX; SPHERICAL MODEL

34130 (INIS-RU–347, pp. 158) **Semiclassical calculation of collective motion parameters of 'cold' nuclei.** Kolomiets, V.M. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Kondrat'ev, V.N. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 3 refs. COLLECTIVE MODEL/response functions; HARMONIC POTENTIAL; NUCLEAR DEFORMATION; RELAXATION TIME; SEMICLASSICAL APPROXIMATION; SINGLE-PARTICLE MODEL; SQUARE-WELL POTENTIAL

34131 (INIS-RU–347, pp. 159) **Nucleon decay of giant resonances.** Vydrug-Vlasenko, S.M. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Kolomiets, V.M. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. GIANT RESONANCE/collective model; GIANT RESONANCE/level widths; DECAY; EMISSION; GAMMA RADIATION; NUCLEON REACTIONS; NUCLEONS

34132 (INIS-RU–347, pp. 160) **Giant dipole resonance with Skyrme forces.** Bal'butsev, E.B. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Unzhakova, A.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs., 1 fig. GIANT RESONANCE MODEL/skyrme potential; CONTINUITY EQUATIONS; EXCITATION; GIANT RESONANCE; PROBABILITY

34133 (INIS-RU–347, pp. 161) **Vibrational 0^+-4^+ excitations in spherical nuclei.** Sinichkin, V.P.; Sinichkina, O.P. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs., 1 tab. CADMIUM 110/vibrational states; CALCIUM 40/vibrational states; LEAD 208/vibrational states; ZIRCONIUM 90/vibrational states; COLLECTIVE EXCITATIONS; MOMENTS METHOD; NUCLEAR POTENTIAL; SPHERICAL MODEL; THEORETICAL DATA; WIGNER FORCE

34134 (INIS-RU–347, pp. 162) **Low-energy giant resonances in spherical nuclei.** Sushkov, A.V. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Bastrukov, S.I. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs. GIANT RESONANCE/e3-transitions; GIANT RESONANCE/e4-transitions; FERMI LEVEL; E3-TRANSITIONS; E4-TRANSITIONS; NUCLEAR DEFORMATION; NUCLEI; ROTATIONAL STATES; SPHERICAL MODEL

34135 (INIS-RU–347, pp. 164) **Magnetic characteristics of collective states of ^{160,162,164}Dy isotopes.** Mikhajlov, I.N.; Usmanov, P.N.; Okhunov, A.A.; Brianson, Sh. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 6 refs., 1 tab. DYSPROSIUM 160/collective excitations; DYSPROSIUM 162/collective excitations; DYSPROSIUM 164/collective excitations; E2-TRANSITIONS; MIXING RATIO; M1-TRANSITIONS; PROBABILITY; THEORETICAL DATA; VIBRATIONAL STATES

34136 (INIS-RU–347, pp. 165) **Low-lying 0^+-levels in magic nuclei and 2p2h correlations in ground state.** Kamerdzhiev, S.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (Russian Federation). Fiziko-Ehnergeticheskij Inst.); Tertychnyj, G.Ya. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 4 refs. CALCIUM 40/energy levels; CALCIUM 40/giant resonance; LEAD 208/energy levels; LEAD 208/giant resonance; CORRELATIONS; E0-TRANSITIONS; GREEN FUNCTION; PARTICLE-HOLE MODEL

34137 (INIS-RU–347, pp. 166) **E1-radiative strength functions in 'heated' deformed nuclei.** Kamerdzhiev, S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR,

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Short communication. 1 ref., 2 figs. ERBIUM 160/e1-transitions; DEFORMED NUCLEI; E1-TRANSITIONS; FERMI GAS MODEL; NUCLEAR TEMPERATURE; PROBABILITY; STRENGTH FUNCTIONS

34138 (INIS-RU–347, pp. 167) **Effect of four quasi-particle configurations and correlations in ground state on the lowest 2^+-state energy.** Efimov, A.D.; Mikhajlov, V.M. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. KRYPTON/excited states; KRYPTON/ground states; SELENIUM/excited states; SELENIUM/ground states; CORRECTIONS; CORRELATIONS; GREEN FUNCTION; KRYPTON; RANDOM PHASE APPROXIMATION; SELENIUM; TAMM-DANCOFF METHOD

34139 (INIS-RU–347, pp. 168) **M1-transitions between high-spin states in ^{79}Kr.** Dojnikov, D.N.; Mikhajlov, V.M. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs., 1 fig. KRYPTON 79/high spin states; KRYPTON 79/m1-transitions; COLLECTIVE MODEL; M1-TRANSITIONS; MATRIX ELEMENTS; PROBABILITY

34140 (INIS-RU–347, pp. 169) **Influence of dynamic effects on relative changes of charge radii of strontium even isotopes.** Kuz'menko, N.K.; Mikhajlov, V.M. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs., 1 tab. STRONTIUM ISOTOPES/nuclear radii; CORRELATIONS; EVEN-EVEN NUCLEI; GROUND STATES; ISOTOPE EFFECTS; PAIRING ENERGY; THEORETICAL DATA; WOODS-SAXON POTENTIAL

34141 (INIS-RU–347, pp. 170) **Self-consistent description of pair correlation effects with semiphenomenological nucleon-nucleon forces.** Krutov, V.A.; Do Man, Kh. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 ref., 1 tab. NEODYMIUM 144/energy levels; BINDING ENERGY; COMPARATIVE EVALUATIONS; HARTREE-FOCK-BOGOLYUBOV THEORY; NUCLEON-NUCLEON INTERACTIONS; OCCUPATION NUMBER; PAIRING INTERACTIONS; THEORETICAL DATA

34142 (INIS-RU–347, pp. 171) **Inertial characteristics of transuranium nuclei in N_pN_n scheme.** Karaev, R.; Safarov, R.Kh. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. HEAVY NUCLEI/moment of inertia; HEAVY NUCLEI/transuranium elements; ATOMIC NUMBER; BACKBENDING; EVEN-EVEN NUCLEI; MASS NUMBER

34143 (INIS-RU–347, pp. 172) **Two-center model of rotational states in atomic nuclei.** Samodelova, G.L.; Sorokin, A.I. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 1 ref. HEAVY NUCLEI/rotational states; INTERMEDIATE MASS NUCLEI/rotational states; LIGHT NUCLEI/rotational states; MASS DISTRIBUTION; MOMENT OF INERTIA; NUCLEAR DEFORMATION; NUCLEAR MODELS; NUCLEAR POTENTIAL

34144 (INIS-RU–347, pp. 201) **Resonances in the ^{36}S(p,γ)^{37}Cl.** Vodin, A.N.; Nemashkalo, B.A.; Kachan, A.S.; Utenkov, S.N. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. CHLORINE 37/energy levels; EXCITATION FUNCTIONS; EXPERIMENTAL DATA; GAMMA RADIATION; MEV RANGE 01-10; PROTON REACTIONS; SPIN; STRENGTH FUNCTIONS; SULFUR 36 TARGET

34145 (INIS-RU–347, pp. 211) **Excitation of ^{53}Ni and ^{54}Fe cores in (antip,p') scattering in the range of E_p=17 MeV.** Plavko, A.V. (Leningradskij Gosudarstvennyj Univ., Leningrad (Russian Federation)). AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. IRON 54/vibrational states; NICKEL 58/vibrational states; COUPLED CHANNEL THEORY; MEV RANGE 01-10; MEV RANGE 10-100; NUCLEAR DEFORMATION; PARTICLE-HOLE MODEL; POLARIZATION-ASYMMETRY RATIO; POLARIZED BEAMS; PROTON REACTIONS; PROTONS; SCATTERING

34146 (INIS-RU–347, pp. 212) **Excitation of 2_1^+ and 2_2^+ states in ^{54,56}Fe, ^{52,60}Ni in (antip,p') scattering at E_p=16 MeV.** Plavko, A.V. (Leningradskij Gosudarstvennyj Univ., Leningrad (Russian Federation)); Kudryashchov, V.I.; Klegg, T.; Karvovski, Kh.; Varner, R.L. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. IRON 54/excited states; IRON 56/excited states; NICKEL/excited states; NICKEL 58/excited states; PROTON REACTIONS/polarization-asymmetry ratio; INELASTIC SCATTERING; MEV RANGE 10-100; NICKEL; POLARIZED BEAMS; PROTONS

34147 (INIS-RU–347, pp. 311) **Study on a density of the excited strongly-deformed states of the actinide nuclei.** Platonov, S.Yu. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Fotina, O.V.; Yuminov, O.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 4 refs. NEPTUNIUM ISOTOPES/excited states; PLUTONIUM ISOTOPES/excited states; PROTACTINIUM 232/excited states; PROTACTINIUM 233/excited states; DEFORMED NUCLEI; SYMMETRY BREAKING

34148 (INIS-RU–347, pp. 314) **Isovector monopole resonances in nuclei with giant neutron halos.** Ogloblin, A.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. HELIUM 6/excited states; HELIUM 8/excited states; LITHIUM 11/excited states; CROSS SECTIONS; NUCLEAR RADII

34149 (INIS-RU–347, pp. 316) **Exotic nuclear quasi molecules.** Shvedov, A.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. NUCLEAR MOLECULES/light nuclei; CARBON 12 TARGET; ELASTIC SCATTERING; HEAVY ION REACTIONS; MEV RANGE 10-100

34150 (INIS-RU–347, pp. 341) **Structure of resonance state wave functions in continuum range for 1d-2s shell nuclei.** Mikhaleva, T.N. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki). AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 4 refs., 1 fig. ALUMINIUM 26/excited states; ALUMINIUM 26/wave functions; DECAY; DIFFERENTIAL CROSS SECTIONS; EXPERIMENTAL DATA; LEVEL WIDTHS; MAGNESIUM 25 TARGET; MEV RANGE 01-10; PROTON REACTIONS

34151 (INIS-RU–347, pp. 443) **Effective potentials and the equation of the hypernuclear matter state.** Lanskoj, D.E. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Tret'yakova, T.Yu. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 figs. NUCLEAR MATTER/equations of state; NUCLEAR MATTER/hypernuclei; EFFECTIVE RANGE THEORY; ENERGY DENSITY; LAMBDA BARYONS; NEUTRON DENSITY; NEUTRONS; HYPERNUCLEI; PARTICLE INTERACTIONS; PROTONS; SKYRME POTENTIAL; STRANGENESS

34152 (ORNL/FTR–4661) **Travel to Denmark and Sweden to attend the conference on Perspectives in Nuclear Structure: Foreign trip report, June 11–23, 1993.** Johnson, N.R. Oak Ridge National Lab., TN (United States). 1 Jul 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93017061. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The traveler attended the conference on Perspectives in Nuclear Structure at the Niels Bohr Institute in Copenhagen. The talks at this conference covered a broad spectrum of topics in nuclear physics. Each speaker tended to review the status of a given area and to address the outlook for the future in that area. The Workshop on Nuclear Spectroscopy at the New Arrays held at the University of Lund, Sweden, concentrated on nuclear structure research where there are opportunities for significant new advancements as a result of the new large arrays of Compton-suppressed germanium detectors now being constructed. The speaker presented an invited tall on "A New Era of Lifetime Measurements With the Large Arrays."

6632 Radioactivity and Electromagnetic Transitions (Excluding Fission)

Refer also to citation(s) 34087, 34116, 34135, 34252, 34296, 34297, 34298, 34433, 34450

34153 (BNL–49336) **Critical evaluation of total half-lives of selected ground state radionuclides.** Holden, N.E. Brookhaven National Lab., Upton, NY (United States). [1993]. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. (CONF-9308148–3: 37. International Union of Pure and Applied Chemistry (IUPAC) meeting, Lisbon (Portugal), 5-12 Aug 1993). Order Number DE93019846. Source: OSTI; NTIS; INIS; GPO Dep.

The half-lives of a number of selected ground state radioactive nuclides have been evaluated and values have been recommended with uncertainties. These are all preliminary recommendations.

34154 (DOE/ER/40553–4) **Nuclear transparency and double beta decay of molybdenum 100: Annual progress report, February 1, 1993–January 31, 1994.** Nicholson, H.W. Mount Holyoke Coll., South Hadley, MA (United States). Jul 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-90ER40553. Order Number DE93019861. Source: OSTI; NTIS; INIS; GPO Dep.

The analysis of the data obtained in an experiment to search for double beta decay in molybdenum 100 with collaborators from the Lawrence Berkeley Laboratory, the University of New Mexico, and the Idaho National Engineering Laboratory has nearly been completed, and a paper giving a lower limit of 0.44×10^{23} years on the lifetime of the $O^+ \rightarrow O_+$ neutrinoless doable beta decay mode has been accepted for publication in Physical Review Letters. A scintillating fiber beam hodoscope has been designed, built, and tested and used in the EVA detector during the June–July run of AGS Experiment 850 at the Brookhaven National Laboratory. The EVA detector is designed to study color transparency in nuclei and large angle exclusive reactions for momenta between 6 and 20 GeV/c incident beam momenta. At present, the construction of all systems of the EVA detector, which consists of a large superconducting solenoid, 5500 straw tubes arranged in four cylinders, and 500 trigger scintillation counters arranged in two rings and 100 channels of beam hodoscope, has nearly been completed, and the detector is currently being calibrated and is taking data at 6 GeV/c incident beam momentum. We have also been invited to join the NEMO international collaboration which is involved in a series of experiments to look for double beta decay in molybdenum 100. Professor Sutton is beginning to study the problems involved in purifying molybdenum 100 as a source for the NEMO 3 detector currently being designed.

34155 (INIS-RU–347, pp. 47) **Radiative strength functions for E1-transitions of some nuclei.** Begzhanov, R.B. (AN Uzbekskoj SSR, Tashkent (Uzbekistan). Inst. Yadernoj Fiziki); Kulabdullaev, G.A.; Razzakova, N. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 4 refs., 1 tab. HEAVY NUCLEI/e1-transitions; INTERMEDIATE MASS NUCLEI/e1-transitions; EXPERIMENTAL DATA; E1-TRANSITIONS; STRENGTH FUNCTIONS

34156 (INIS-RU–347, pp. 49) **Electron capture-to-positron emission for decay of ^{58}Co and ^{74}As.** Begzhanov, R.B. (AN Uzbekskoj SSR, Tashkent (Uzbekistan). Inst. Yadernoj Fiziki); Azimov, K.Sh.; Meliev, M.J.; Narzikulov, M. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. ARSENIC 74/beta-plus decay; ARSENIC 74/k capture; COBALT 58/beta-plus decay; COBALT 58/k capture; EXPERIMENTAL DATA; GERMANIUM 74; IRON 58; PROBABILITY

34157 (INIS-RU–347, pp. 50) **Determination of k capture probabilities for decay of ^{75}Se.** Begzhanov, R.B. (AN Uzbekskoj SSR, Tashkent (Uzbekistan). Inst. Yadernoj Fiziki); Azimov, K.Sh.; Meliev, M.J.; Mukhammadiev, A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. SELENIUM 75/k capture; ARSENIC 75; EXPERIMENTAL DATA; PROBABILITY

34158 (INIS-RU–347, pp. 54) **Yrast band of ^{93}Nb.** Zobov, A.E.; Mishin, A.S.; Rassadin, L.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs., 1 tab. NIOBIUM 93/yrast states; ANGULAR DISTRIBUTION; ENERGY-LEVEL TRANSITIONS; EXPERIMENTAL DATA; OXYGEN 16 REACTIONS; SELENIUM 80 TARGET

34159 (INIS-RU–347, pp. 57) **K capture probabilities at the ^{101}Rh decay.** Begzhanov, R.B. (AN Uzbekskoj SSR, Tashkent (Uzbekistan). Inst. Yadernoj Fiziki); Narzikulov, R.D.; Magrupov, R.D.; Mirakhmedov, Sh.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. RHODIUM 101/k capture; EXCITED STATES; EXPERIMENTAL DATA; PROBABILITY; RUTHENIUM 101

34160 (INIS-RU–347, pp. 58) **Intensity of ^{102}Ru gamma-radiation from the (α,2nγ) reaction.** Kudoyarov, M.F. (AN SSSR, Leningrad (Russian Federation). Fiziko-Tekhnicheskij Inst.); Kuz'min, E.V.; Pasternak, A.A.; Gonusek, M.; Shpalek, A.; Adam, T. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs., 1 tab. RUTHENIUM 102/energy-level transitions; ALPHA REACTIONS; EXPERIMENTAL DATA; GAMMA RADIATION; MOLYBDENUM 100 TARGET; TRANSITION AMPLITUDES

34161 (INIS-RU–347, pp. 64) **Fast E2-transitions between states of intruder bands of ^{116,118}Sn.** Kudoyarov, M.F. (AN SSSR, Leningrad (Russian Federation). Fiziko-Tekhnicheskij Inst.); Kuz'min, E.V.; Pasternak, A.A.; Lobach, Yu.N. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 4 refs., 1 fig. TIN 116/e2-transitions; TIN 118/e2-transitions; PROBABILITY; ROTATIONAL STATES; E2-TRANSITIONS

34162 (INIS-RU–347, pp. 65) **Investigation of ^{120}Sn γ-transitions in the (n,n'γ) reactions.** Demidov, A.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (Russian Federation). Inst. Atomnoj Ehnergii); Mikhajlov, I.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 tab. TIN 120/energy levels; TIN 120/multipole transitions; EXPERIMENTAL DATA; GAMMA RADIATION; MIXING RATIO; NEUTRON REACTIONS

34163 (INIS-RU–347, pp. 66) **Spectra of γ-γ coincidences for ^{124}Te in the (n,γ) reaction.** Prokof'ev, P.T. (AN Latvijskoj SSR, Riga (Latvia). Inst. Fiziki); Bejtin'sh, M.R.; Bondarenko, V.A.; Kuvaga, I.L. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs., 1 tab. TELLURIUM 124/energy-level transitions; ENERGY LEVELS; EXPERIMENTAL DATA; GAMMA RADIATION; NEUTRON REACTIONS

34164 (INIS-RU–347, pp. 68) **Gamma of the ^{135}Ba compound state.** Bondarenko, V.A. (AN Latvijskoj SSR, Riga (Latvia). Inst. Fiziki); Kuvaga, I.L.; Prokof'ev, P.T.; Le Khong Kkh'em; Popov, Yu.P.; Sukhovoj, A.M.; Fam Dinkh Kkhang; Khitrov, V.A.; Khol'nov, Yu.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24

Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. BARIUM 135/compound nuclei; BARIUM 135/gamma decay; GAMMA CASCADES

34165 (INIS-RU–347, pp. 69) **K shell autoionization in the ^{141}Ce beta decay.** Begzhanov, R.B. (AN Uzbekskoj SSR, Tashkent (Uzbekistan). Inst. Yadernoj Fiziki); Azimov, K.Sh.; Meliev, M.J.; Narzikulov, M. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. CERIUM/autoionization; CERIUM 141/beta-minus decay; CERIUM; AUTOIONIZATION; EXPERIMENTAL DATA; K SHELL; PROBABILITY

34166 (INIS-RU–347, pp. 71) **Cascades of γ-transitions of the ^{143}Nd compound state decay.** Le Khong Kkh'em (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Popov, Yu.P.; Sukhovoj, A.M.; Fam Dinkh Kkhang; Khitrov, V.A.; Khol'nov, Yu.V.; Bondarenko, V.A.; Kuvaga, I.L.; Prokof'ev, P.T. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. NEODYMIUM 143/compound nuclei; NEODYMIUM 143/gamma cascades; TRANSITION AMPLITUDES

34167 (INIS-RU–347, pp. 72) **High-spin isomer in ^{143}Sm.** Bykov, V.T.; Goncharov, K.S.; Kuz'menko, V.A.; Remaev, V.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref., 1 tab. SAMARIUM 143/isomeric nuclei; CESIUM 133 TARGET; EXPERIMENTAL DATA; HALF-LIFE; ISOMERIC TRANSITIONS; NITROGEN 14 REACTIONS; TRANSITION AMPLITUDES

34168 (INIS-RU–347, pp. 74-75) **Investigation of γ-radiation for ^{147}Tb ($T_{1/2}$=1.7h).** Vavryshchuk, Ya. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Potempa, A.V.; Kalinnikov, V.G. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 tab. TERBIUM 147/energy-level transitions; EXPERIMENTAL DATA; GAMMA RADIATION; TRANSITION AMPLITUDES

34169 (INIS-RU–347, pp. 76-77) **Decay of ^{143}Tb (60 min).** Kratsikova, T.I. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Shchus', A.F.; Tlusty, P.; Finger, M.; Yanata, A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs., 1 tab. GADOLINIUM 142/energy levels; GADOLINIUM 142/energy-level transitions; TERBIUM 143/beta decay; ELECTRONS; EXPERIMENTAL DATA; GAMMA RADIATION; INTERNAL CONVERSION; MULTIPOLARITY; ORIENTED NUCLEI; PARITY; SPIN; X RADIATION

34170 (INIS-RU–347, pp. 78) **444.6 keV-isomeric transition in ^{152}Gd.** Kartashov, V.M. (AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki); Oborovskij, A.I.; Troitskaya, A.G. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs., 1 tab. GADOLINIUM 152/isomeric transitions; E4-TRANSITIONS; GAMMA RADIATION; MIXING RATIO; NUCLEAR DEFORMATION

34171 (INIS-RU–347, pp. 79) **Measurement of isotope shifts and hyperfine splitting for ytterbium neutron-deficient isotopes by means of high-sensitivity atomic spectroscopy.** Alkhazov, G.D. (AN SSSR, Leningrad (Russian Federation). Inst. Yadernoj Fiziki); Barzakh, A.E.; Denisov, V.P. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. RESONANCE IONIZATION MASS SPECTROSCOPY; YTTERBIUM ISOTOPES/spectral shift; ENERGY-LEVEL TRANSITIONS; EXPERIMENTAL DATA; HALF-LIFE; HYPERFINE STRUCTURE; ION SOURCES; ION SPECTROSCOPY; NEUTRON-DEFICIENT ISOTOPES; NUCLEAR MAGNETIC MOMENTS; QUADRUPOLE MOMENTS

34172 (INIS-RU–347, pp. 80) **Alpha decay of ^{156}Er.** Kalinnikov, V.G. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Zaparov, Sh.Eh.; Evtisov, S.V.; Kulikov, E.V.; Osipenko, B.P.; Solnyshkin, A.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. ERBIUM 156/alpha decay; ALPHA PARTICLES; HALF-LIFE; MEV RANGE 100-1000; PROTON REACTIONS; TANTALUM; TARGETS

34173 (INIS-RU–347, pp. 81) **Scheme of decay of the 7937 keV ^{158}Gd compound state excited in (n,γ) reaction.** Ali, M.A. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Vasil'eva, Eh.V.; Vojnov, A.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. GADOLINIUM 158/energy levels; GADOLINIUM 158/energy-level transitions; GADOLINIUM 157 TARGET; GAMMA RADIATION; NEUTRON REACTIONS; THERMAL NEUTRONS

34174 (INIS-RU–347, pp. 82) **Parametrization of radiative transitions in high-spin rotational band with alignment of internal angular moment.** Safarov, R.R.; Safarov, R.Kh. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. ERBIUM 158/e2-transitions; E2-TRANSITIONS; HIGH SPIN STATES; NUCLEAR DEFORMATION; PROBABILITY; QUADRUPOLE MOMENTS; SPIN; YRAST STATES

34175 (INIS-RU–347, pp. 88) **Investigation of γ-transitions of ^{170}Er in (n,n'γ) reaction.** Berendakov, S.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (Russian Federation). Inst. Atomnoj Ehnergii); Demidov, A.M. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. ERBIUM 170/energy-level transitions; ENERGY LEVELS; ERBIUM 170 TARGET; GAMMA RADIATION; NEUTRON REACTIONS; NEUTRONS; PARITY; POLARIZED PRODUCTS; SPIN

34176 (INIS-RU–347, pp. 89) **Autoionization of K shell in β-decay of ^{170}Tm.** Begzhanov, R.B. (AN Uzbekskoj SSR, Tashkent (Uzbekistan). Inst. Yadernoj Fiziki); Gladyshev, D.A.; Mirakhmedov, Sh.A.; Meliev, M.J.; Magrupov, R.D.; Narzikulov, M. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. THULIUM/autoionization; THULIUM 170/beta decay; EXPERIMENTAL DATA; GAMMA RADIATION; K SHELL; PROBABILITY; THULIUM; AUTOIONIZATION; X RADIATION

34177 (INIS-RU–347, pp. 91) **Strength functions of $β^+$ (electron capture) decays and delayed fission of neutron-deficient pre-actinide nuclei.** Izosimov, I.N. (Radievyj Inst., Leningrad (Russian Federation)). AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. BETA-PLUS DECAY/strength functions; ELECTRON CAPTURE DECAY/strength functions; NEUTRON-DEFICIENT ISOTOPES/beta-plus decay; NEUTRON-DEFICIENT ISOTOPES/electron capture decay; BISMUTH 188; BISMUTH 190; GAMOW-TELLER RULES; MERCURY ISOTOPES; PLATINUM 174; PROBABILITY

34178 (INIS-RU–347, pp. 92) **Exhibition of backbending for ^{176}Hf.** Grigor'ev, E.P. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs., 1 tab. HAFNIUM 176/backbending; HAFNIUM 176/rotational states; EXPERIMENTAL DATA; GAMMA RADIATION; BACKBENDING; MAGNETIC MOMENTS; MULTIPOLE TRANSITIONS; PARITY; SPIN

34179 (INIS-RU–347, pp. 93) **Study on the ^{177}Lu in (n,2γ) reaction.** Bejtin'sh, M.R. (AN Latvijskoj SSR, Riga (Latvia). Inst. Fiziki); Bondarenko, V.A.; Kuvaga, I.L. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. LUTETIUM 177/excited states; LUTETIUM 177/gamma cascades; COMPOUND NUCLEI; GAMMA RADIATION; NEUTRON REACTIONS; PARITY; SPIN

34180 (INIS-RU–347, pp. 96) **Transitions between the 7/2$^+$ (633) and 7/2$^-$ (514) bands in ^{177}Hf.** Dzhelepov, B.S. (Radievyj Inst., Leningrad (Russian Federation)); Zhukovskij, N.N.; Shestopalov, S.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. HAFNIUM 177/energy-level transitions; GAMMA RADIATION; MIXING RATIO; QUANTUM NUMBERS; WAVE FUNCTIONS

34181 (INIS-RU–347, pp. 97) **New method of theoretical γ-spectroscopy.** Dzhelepov, B.S. (Radievyj Inst., Leningrad (Russian Federation)); Zhukovskij, N.N.; Shestopalova, S.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. GAMMA SPECTROSCOPY/multiparameter analysis; DATA PROCESSING; ENERGY LEVELS; ENERGY-LEVEL TRANSITIONS; HAFNIUM 177; MIXING RATIO; PARITY; SPIN; TRANSITION AMPLITUDES

34182 (INIS-RU–347, pp. 98) **Alagi rules violation in transitions between the 9/2$^+$(624) and 7/2$^-$(514) band levels in ^{177}Hf.** Abdurazakov, A.A.; Karakhodzhaev, A.K.; Khajtkulova, I.I. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref., 1 tab. HAFNIUM 177/energy-level transitions; ENERGY LEVELS; GAMMA RADIATION; PARITY; PROBABILITY; SPIN; THEORETICAL DATA

34183 (INIS-RU–347, pp. 101) **Investigation on the ^{181}Hf decay.** Zheltonozhskij, V.A.; Lebedev, Yu.A.; Ukhin, M.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and

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Short communication. 1 ref., 2 tabs. HAFNIUM 181/k conversion; HAFNIUM 181/l conversion; ELECTRONS; EXPERIMENTAL DATA; E2-TRANSITIONS; GAMMA RADIATION; M1-TRANSITIONS; TRANSITION AMPLITUDES; X RADIATION

34184 (INIS-RU–347, pp. 102) **Investigation on the γ102 keV internal conversion in ^{183}Ta decay.** Mitrokhovich, N.F. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Sidorenko, L.P.; Feoktistov, A.I. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. TANTALUM 183/l conversion; ELECTRONS; E3-TRANSITIONS; MIXING RATIO; M2-TRANSITIONS; TRANSITION AMPLITUDES

34185 (INIS-RU–347, pp. 103) **Investigation on the ^{183}W excited states in neutron reactions.** Afanas'ev, A.V. (AN Latvijskoj SSR, Riga (Latvia). Inst. Fiziki); Bejtin'sh, M.R.; Bondarenko, V.A.; Kuvaga, I.L.; Prokof'ev, P.T.; Simonova, L.I.; Rezvaya, G.L. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. TUNGSTEN 183/energy levels; TUNGSTEN 183/energy-level transitions; EXPERIMENTAL DATA; FAST NEUTRONS; GAMMA RADIATION; NEUTRON REACTIONS; PARITY; SPIN; THERMAL NEUTRONS; TUNGSTEN 182 TARGET; TUNGSTEN 183 TARGET

34186 (INIS-RU–347, pp. 104) **Spectra of γγ-coincidences of ^{187}W in (n,γ) reaction.** Afanas'ev, A.V. (AN Latvijskoj SSR, Riga (Latvia). Inst. Fiziki); Berzin', Ya.Ya.; Bondarenko, V.A.; Kuvaga, I.L.; Prokof'ev, P.T.; Simonova, L.I.; Rezvaya, G.L. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs., 1 tab. TUNGSTEN 187/energy-level transitions; EXPERIMENTAL DATA; GAMMA RADIATION; NEUTRON REACTIONS; THERMAL NEUTRONS; TUNGSTEN 186 TARGET

34187 (INIS-RU–347, pp. 108) **Investigation on the ^{196m1,196m}Au decay.** Zheltonozhskij, V.A. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Majdanyuk, V.K.; Reshit'ko, S.V.; Tarakanov, V.K. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 tab. GOLD 196/energy-level transitions; GOLD 198/energy-level transitions; DEUTERON REACTIONS; EXPERIMENTAL DATA; GAMMA RADIATION; GOLD 197 TARGET; HALF-LIFE; ISOMERIC NUCLEI; NEUTRON REACTIONS; NEUTRONS; PLATINUM 198 TARGET; TRANSITION AMPLITUDES

34188 (INIS-RU–347, pp. 120) **Simple microscopic model of beta-decay strength function.** Borzov, I.N.; Lyutostanskij, Yu.S.; Panov, I.V.; Trykov, E.L.; Fayans, S.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. KRYPTON 90/beta decay; KRYPTON 96/beta decay; STRONTIUM 102/beta decay; STRONTIUM 94/beta decay; DAUGHTER PRODUCTS; DELAYED NEUTRONS; GAMOW-TELLER RULES; HALF-LIFE; NEUTRON EMISSION; PROBABILITY; STRENGTH FUNCTIONS

34189 (INIS-RU–347, pp. 124) **Charged particle scattering on isotones.** Popushoj, M.N. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref., 1 fig. EVEN-EVEN NUCLEI/alpha decay; EVEN-EVEN NUCLEI/isotonic nuclei; ALPHA PARTICLES; DAUGHTER PRODUCTS; ENERGY DEPENDENCE; HADRON REACTIONS

34190 (INIS-RU–347, pp. 129) **Distribution oven states of M2-transition forces in odd nuclei of p shell.** Arakelyan, Eh.R. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation)); Goncharova, N.G. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 fig. LITHIUM 7/m2-transitions; FORM FACTORS; ISOSPIN; M2-TRANSITIONS; MATRIX ELEMENTS; P STATES

34191 (INIS-RU–347, pp. 139-140) **Nature of nuclear collective modes of negative parity.** Brianson, Sh.; Mikhajlov, I.N.; Usmanov, P.N. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs., 1 tab. COLLECTIVE MODEL/multipole transitions; RADIUM 226/collective excitations; ENERGY LEVELS; EXPERIMENTAL DATA; GAMMA RADIATION; MATRIX ELEMENTS; PARITY; PROBABILITY; SPIN; THEORETICAL DATA

34192 (INIS-RU–347, pp. 163) **Microscopic description of nonadiabatic behaviour of E2-transitions in the rare-earth nuclei.** Nesterenko, V.O.; Usmanov, P.N.; Okhunov, A.A.; Fatlander, K. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 3 refs., 2 figs. RARE EARTH NUCLEI/e2-transitions; ERBIUM 166; MATRIX ELEMENTS; RANDOM PHASE APPROXIMATION; E2-TRANSITIONS; ROTATIONAL STATES

34193 (INIS-RU–347, pp. 173) **Cluster radioactivity of nuclei with A<208.** Mikheev, V.L. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Furman, V.I.; Chuvil'skij, Yu.M.; Kadmenskij, S.G.; Kurgalin, S.D. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs. HEAVY ION DECAY RADIOISOTOPES/heavy nuclei; HEAVY ION DECAY RADIOISOTOPES/intermediate mass nuclei; HEAVY ION EMISSION DECAY; ALPHA DECAY; LEVEL WIDTHS; MASS NUMBER

34194 (INIS-RU–347, pp. 174) **Spectroscopic factors and classification of cluster decays of even-even nuclei.** Furman, V.I. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Chuvil'skij, Yu.M. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs. HEAVY NUCLEI/heavy ion emission decay; HEAVY NUCLEI/spectroscopic factors; DAUGHTER PRODUCTS; MASS NUMBER

34195 (INIS-RU–347, pp. 176) **Two-neutrino double beta decay of ^{110}Mo in ^{100}Ru excited states.** Barabash, A.S.; Avin'on, F.T.; Gerard, K.K.; Brodzinskij, R.L.; Milej, M.S.; Rivs, Dzh.N.; Yumatov, V.I. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 3 refs. MOLYBDENUM 100/double beta decay; RUTHENIUM 100/energy-level transitions; EXPERIMENTAL DATA; GAMMA RADIATION; HALF-LIFE; NEUTRINOS

34196 (INIS-RU–347, pp. 177) **On the probability of ^{235}U isomeric transition in silver.** Kol'tsov, V.V. (Radievyj Inst., Leningrad (Russian Federation)). AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 3 refs. URANIUM 235/electromagnetic fields; URANIUM 235/isomeric transitions; FLUCTUATIONS; RESONANCE; SILVER

34197 (INIS-RU–347, pp. 180) **On the data authenticity of most commonly used tables on internal conversion coefficients.** Band, I.M. (AN SSSR, Leningrad (Russian Federation). Inst. Yadernoj Fiziki); Trzhaskovskaya, M.B. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 5 refs. INTERNAL CONVERSION; ATOMIC NUMBER; ELECTRONIC STRUCTURE; ERRORS; INTERMEDIATE MASS NUCLEI; MULTIPOLE TRANSITIONS; THEORETICAL DATA; URANIUM

34198 (INIS-RU–347, pp. 182) **Conversion electron spectrum of 1.56 keV transition in ^{201}Hg.** Gerasimov, V.R.; Grebennikov, D.V.; Kulakov, V.M.; Lisin, S.K.; Kharitonov, V.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 4 refs. MERCURY 201/internal conversion; ELECTRONS; EXPERIMENTAL DATA; E2-TRANSITIONS; MIXING RATIO; M1-TRANSITIONS; TRANSITION AMPLITUDES

34199 (INIS-RU–347, pp. 183) **Nuclear gamma-transitions in condensed media.** Batkin, I.S. (Voronezhskij Gosudarstvennyj Univ., Voronezh (Russian Federation)); Dolgopolov, M.A.; Lyuboshits, V.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. URANIUM 235/crystals; URANIUM 235/energy-level transitions; ANGULAR DISTRIBUTION; EXCITED STATES; GAMMA RADIATION; PROBABILITY; CRYSTALS

34200 (INIS-RU–347, pp. 185) **Tritium beta-decay with beta-electron transition into bound state.** Batkin, I.S. (Voronezhskij Gosudarstvennyj Univ., Voronezh (Russian Federation)); Kopytin, I.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. TRITIUM/beta decay; ELECTRONS; ENERGY-LEVEL TRANSITIONS; HELIUM; PROBABILITY; S STATES; THEORETICAL DATA; TRITIUM

34201 (INIS-RU–347, pp. 186) **Experimental study on the K-shell autoionization probability in ^{203}Hg beta-decay.** Shumejko, A.P. (Voronezhskij Gosudarstvennyj Univ., Voronezh (Russian Federation)); Bushakhma, Kh.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 4 refs. MERCURY 203/beta decay; THALLIUM 203/inner-shell ionization; EXPERIMENTAL DATA; GAMMA RADIATION; K SHELL; PROBABILITY

34202 (INIS-RU–347, pp. 187) **Angular distribution of internal bremsstrahlung quanta from beta decay of polarized nuclei.** Batkin, I.S. (Voronezhskij Gosudarstvennyj Univ., Voronezh (Russian Federation)); Bushakhma, Kh.A.; Churakova, T.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of*

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Short communication. 1 ref. ORIENTED NUCLEI/beta decay; ORIENTED NUCLEI/internal bremsstrahlung; ANGULAR DISTRIBUTION; ASYMMETRY COEFFICIENTS; NEUTRONS; PROBABILITY; THEORETICAL DATA; TRITIUM

34203 (INIS-RU–347, pp. 188) **Calculation of relative probabilities of atomic electron capture by nucleus.** Remeta, E.Yu. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Ganich, P.P. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. CERIUM 139/electron capture decay; ELECTRONIC STRUCTURE; GROUND STATES; LANTHANUM 139; PROBABILITY; THEORETICAL DATA

34204 (INIS-RU–347, pp. 189) **Two-photon 0^+-0^+ transition in ^{90}Zr.** Basenko, V.K. (Kievskij Gosudarstvennyj Univ., Kiev (Ukraine)); Berlizov, A.V.; Prokopets, G.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 4 refs. ZIRCONIUM 90/energy-level transitions; EXCITED STATES; EXPERIMENTAL DATA; GAMMA RADIATION; MULTI-PHOTON PROCESSES; PROBABILITY

34205 (INIS-RU–347, pp. 190) **Estimation of probability for the two-photon decay of the ^{137}Ba 662 keV isomeric state.** Basenko, V.K. (Kievskij Gosudarstvennyj Univ., Kiev (Ukraine)); Berlizov, A.N.; Prokopets, G.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 4 refs. BARIUM 137/isomeric nuclei; BARIUM 137/multi-photon processes; MULTIPOLE TRANSITIONS; PROBABILITY; THEORETICAL DATA

34206 (INIS-RU–347, pp. 191) **Study on the electronic shell reconstruction influence on the low-energy conversion transition in ^{90m}Tc.** Trusov, V.F. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 4 refs. TECHNETIUM 90/internal conversion; TECHNETIUM 90/isomeric nuclei; ELECTRONIC STRUCTURE; E3-TRANSITIONS

34207 (INIS-RU–347, pp. 193) **Alpha-, beta- and proton stability of mean and heavy nuclei.** Garin, B.G. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Kolesnikov, N.N. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. INTERMEDIATE MASS NUCLEI/alpha decay; INTERMEDIATE MASS NUCLEI/beta decay; INTERMEDIATE MASS NUCLEI/proton-emission decay; BINDING ENERGY; FT VALUE; HALF-LIFE; STABILITY

34208 (INIS-RU–347, pp. 194) **Probabilities of beta-transitions in dynamical collective model.** Krygin, G.B. (Kievskij Gosudarstvennyj Univ., Kiev (Ukraine)); Kurgeeva, A.A.; Mitroshin, V.E. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. BETA DECAY/collective model; ANTIMONY ISOTOPES; ENERGY LEVELS; FT VALUE; PROBABILITY; THEORETICAL DATA; TIN ISOTOPES

34209 (INIS-RU–347, pp. 202) **Angular distribution of γ-quanta produced in M1-resonance decay calculated from the first excited state of ^{34}Cl.** Kachan, A.S.; Vodin, A.N.; Nemashkalo, B.A.; Slabospitskij, R.P. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. CHLORINE 34/m1-transitions; ANGULAR DISTRIBUTION; M1-TRANSITIONS; ENERGY LEVELS; GAMMA RADIATION; ISOSPIN; MEV RANGE 01-10; PROTON REACTIONS; SPIN; SULFUR 33 TARGET

34210 (INIS-RU–347, pp. 203) **E1-radiative decay of analog resonance in ^{35}Cl.** Vodin, A.N.; Nemashkalo, B.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. CHLORINE 35/e1-transitions; ANGULAR CORRELATION; ANGULAR DISTRIBUTION; E1-TRANSITIONS; GAMMA DECAY; GAMMA RADIATION; ISOBARIC ANALOGS; LEVEL WIDTHS; MEV RANGE 01-10; PROTON REACTIONS; RESONANCE; SULFUR 34 TARGET

34211 (INIS-RU–347, pp. 240) **On some regularities of the decay of input states produced in the (γ,n) reaction in the 1f 712 shell regin of nuclei.** Ratner, B.S. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 4 refs. IRON 53/f states; ENERGY-LEVEL TRANSITIONS; IRON 54 TARGET; PHOTONUCLEAR REACTIONS

34212 (INIS-RU–347, pp. 242) **Investigation of ^{81}Br($T_{1/2}$=35μs) isomer photoexcitation in the 3.5-5.5 range.** Dubenskij, A.P.; Dubenskij, V.P.; Bojkova, E.A. AN SSSR,

Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. BROMINE 81/isomeric nuclei; ENERGY DEPENDENCE; EXCITED STATES; MEV RANGE 01-10; NUCLEAR REACTION YIELD; PHOTONUCLEAR REACTIONS

34213 (INIS-RU–347, pp. 300) **Role of final-state NN interaction in the ^{6}He(2^{+}),^{6}Li (2^{+},T=1) and ^{6}Be(2^{+}) three-particle decays.** Bochkarev, O.V.; Korzhaninnikov, A.A.; Kuz'min, B.A.; Mukha, I.G.; Chulkov, L.V.; Yan'kov, G.B. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 4 refs. BERYLLIUM 6/alpha decay; HELIUM 6/alpha decay; LITHIUM 6/alpha decay; ALPHA PARTICLES; DECAY AMPLITUDES; FINAL-STATE INTERACTIONS; K-HARMONICS METHOD; NUCLEONS

34214 (INIS-RU–347, pp. 309) **Analysis of time characteristics of the excited actinide nucleus decay using of phenomenological model of level density.** Platonov, S.Yu. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Fotina, O.V.; Yuminov, O.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 4 refs. NEPTUNIUM ISOTOPES/fission; PLUTONIUM ISOTOPES/fission; PROTACTINIUM ISOTOPES/fission; FISSION; NUCLEAR DECAY

34215 (INIS-RU–347, pp. 322) **Integral formalism of alpha-decay. Antisymmetrized version.** Kurgalin, S.D. (Voronezhskij Gosudarstvennyj Univ., Voronezh (Russian Federation)); Chuvil'skij, Yu.M. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. ELEMENT 114/alpha decay; ALPHA PARTICLES; ELEMENT 112; LEVEL WIDTHS; NUCLEAR REACTION KINETICS; Q-VALUE

34216 (INIS-RU–347, pp. 367) **Spontaneous and induced two-body fragmentation.** Rubchenya, V.A.; Yavshits, S.G. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. RADIUM 223/carbon 14 emission decay; RADIUM 223/nuclear fragmentation; COLLECTIVE MODEL; ENERGY SPECTRA; EXCITED STATES; NUCLEAR FRAGMENTS; PROBABILITY

34217 (INIS-RU–347, pp. 428) **New estimation of the characteristics values of decay and radiation ^{44}Ti+^{44}Sc, ^{51}Cr, ^{113}Sn+^{113m}In.** Artamonova, K.P. (Leningradskij Gosudarstvennyj Univ., Leningrad (Russian Federation)); Chechev, V.P. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs., 1 tab. CHROMIUM 51/x radiation; SCANDIUM 44/x radiation; TIN 113/x radiation; TITANIUM 44/x radiation; BETA DECAY; COMPARATIVE EVALUATIONS; EVALUATED DATA; HALF-LIFE; INDIUM 113; ISOMERIC NUCLEI; ISOTOPE RATIO; KEV RANGE 10-100; KEV RANGE 100-1000

34218 (INIS-RU–347, pp. 431) **^{241}Am decay.** Belyavenko, V.S. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Zheltonozhskij, V.A.; Zelinskij, A.G.; Reshit'ko, S.V.; Ukhin, M.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs., 1 tab. AMERICIUM 241/gamma radiation; AMERICIUM 241/x radiation; ENERGY-LEVEL TRANSITIONS; KEV RANGE 10-100; NUCLEAR DECAY; X-RAY SOURCES

34219 (INIS-RU–347, pp. 446-447) **Cross sections of (p,X)-reactions in molibdenum target at E_p=660 MeV.** Aleksandrov, Yu.V. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Astapov, A.A.; Vasil'ev, S.K. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs., 1 tab. MOLYBDENUM/proton reactions; CROSS SECTIONS; FLUX DENSITY; GAMMA SPECTROSCOPY; HALF-LIFE; ISOTOPE PRODUCTION; MEV RANGE 100-1000; MOLYBDENUM; RADIOISOTOPES; TARGETS

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Refer also to citation(s) 33988, 33998, 34122, 34388

34220 (BUP–1992-11) **Proton elastic scattering in neutron-halo nuclei.** Gareev, F.A. (Kurchatov Inst., Moscow (Russian Federation)); Goncharov, S.A.; Vaagen, J.S. Bergen Univ. (Norway). Dept. of Physics. 1992. 11p. Order Number DE94600402. Source: OSTI; NTIS; INIS.

Elastic scattering of proton from ^{6}Li and ^{6}He is studied in the intermediate energy region ($E_p \geq 100$ MeV) in a folding model with "realistic" target densities which reproduce the r.m.s. radii and a range of electroweak data. The scattering clearly reflects the size of the systems, but is only marginally able to discriminate between details of the correlated valence structures of the two nuclei. At forward angles where the direct fingerprint of the presence of a halo structure is expected, the cross section differences are small. At large angles where the response of the α-core on the halo structure is probed, the differences found are accompanied by a falling cross-section magnitude. Likewise, only a weak dependence is found to differences in the halo-tail corresponding to three calculations for ^{11}Li which all reproduce the experimental r.m.s. radius. 12 refs., 3 figs.

34221 (INIS-RU–347, pp. 269) **Study on the (α, ^{3}He) reaction on the ^{16}O, ^{28,30}Si, ^{32}S nuclei the ^{30}Si at 50.5 MeV.** Adonin, V.V. (and others); Basybekov, K.B.; Blokhman, A.M. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. ALPHA REACTIONS/pickup reactions; OXYGEN 16 TARGET/alpha reactions; SILICON 28 TARGET/alpha reactions; SILICON 30 TARGET/alpha reactions; SULFUR 32 TARGET/alpha reactions; EXPERIMENTAL DATA

34222 (INIS-RU–347, pp. 324) **Duration of compound reactions in frameworks of random matrix model.** Ezhov, S.N. (Kievskij Gosudarstvennyj Univ., Kiev (Ukraine)). AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 4 refs. COMPOUND-NUCLEUS REACTIONS/nuclear reaction kinetics; ELASTIC SCATTERING; INELASTIC SCATTERING; MATRICES; MATRIX ELEMENTS; SHELL MODELS

34223 (INIS-RU–347, pp. 336) **Deuteron stripping reaction at intermediate energies.** Berezhnoj, Yu.A. (Khar'kovskij Gosudarstvennyj Univ., Kharkov (Ukraine)); Korda, V.Yu. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. STRIPPING/diffraction models; DEUTERONS; DIFFERENTIAL CROSS SECTIONS; FORM FACTORS; INTEGRAL CROSS SECTIONS; NUCLEAR RADII; NUCLEI; STRIPPING

34224 (INIS-RU–347, pp. 343) **Calculation of scattering NN-phase by phase function method.** Dotsenko, I.S. (Kievskij Gosudarstvennyj Univ., Kiev (Ukraine)); Sosov, Yu.V.; Tartakovskij, V.K. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. NUCLEON-NUCLEON INTERACTIONS/phase shift; BLATT-BIEDENHARN FORMALISM; ENERGY LEVELS; MEV RANGE 100-1000; NUCLEON-NUCLEON POTENTIAL; WAVE FUNCTIONS

34225 (INIS-RU–347, pp. 345) **J matrix formalism in three-body problem.** Knyr, V.A. (Khabarovskij Politekhnicheskij Inst., Khabarovsk (Russian Federation)); Stotland, L.Ya. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 4 refs., 1 fig. LITHIUM 7/hypernuclei; LITHIUM 7/three-body problem; THREE-BODY PROBLEM; DIFFERENTIAL CROSS SECTIONS; KAON MINUS REACTIONS; LAMBDA PARTICLES; HYPERNUCLEI; LITHIUM 7 TARGET; MATRICES

34226 (INIS-RU–347, pp. 346) **Off-energy-shell behaviour of KN, πN and NN scattering amplitudes in one-meson exchange model.** Berdnikov, Ya.A.; Grachev, A.V.; Kosmach, V.F.; Shishlo, A.P. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 6 refs. KAON-NUCLEON INTERACTIONS/scattering amplitudes; NUCLEON-NUCLEON INTERACTIONS/scattering amplitudes; PION-NUCLEON INTERACTIONS/scattering amplitudes; OBE MODEL; POTENTIALS; SCATTERING

34227 (INIS-RU–347, pp. 350) **Scattering of vector charged particles in nucleus Coulomb field.** Tartakovskij, V.K. (Kievskij Gosudarstvennyj Univ., Kiev (Ukraine)); Cherednichenko, V.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. CHARGED PARTICLES/coulomb field; CHARGED PARTICLES/scattering; ATOMIC NUMBER; SCATTERING; DIFFERENTIAL CROSS SECTIONS; NUCLEAR REACTIONS; NUCLEI

34228 (INIS-RU–347, pp. 351) **Woolf-Bragg scattering of alpha-particles on nuclei.** Lednov, D.A. (AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki); Yushkov, A.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 4 refs. ALPHA REACTIONS/crystals; ALPHA REACTIONS/scattering; ALPHA BEAMS; CRYSTALS; SCATTERING; BRAGG REFLECTION; CLUSTER MODEL; CUBIC LATTICES; NUCLEI; SCATTERING AMPLITUDES

34229 (INIS-RU–347, pp. 365) **Double nuclear system as the initial state for compound nucleus production - new mechanism of heavy nuclear system fusion: Model.** Antonenko, N.V. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Volkov, V.V.; Permyakov, V.P.; Cherepanov, E.A.; Nasirov, A.K. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. HEAVY ION FUSION REACTIONS/nuclear models; ANGULAR MOMENTUM; COMPOUND NUCLEI; CROSS SECTIONS; FAST FISSION; FISSION BARRIER; MOLYBDENUM 100 REACTIONS; MOLYBDENUM 100 TARGET; NUCLEAR REACTION KINETICS; PALLADIUM 110; PALLADIUM 110 TARGET

34230 (INIS-RU–347, pp. 366) **Double nuclear system as the initial state for compound nucleus production - new mechanism of heavy nuclear system fusion: Comparison with the**

experiment. Antonenko, N.V. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Volkov, V.V.; Permyakov, V.P.; Cherepanov, E.A.; Nasirov, A.K. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 fig. HEAVY ION FUSION REACTIONS; MOLYBDENUM 100 REACTIONS/heavy ion fusion reactions; MOLYBDENUM 100 TARGET/molybdenum 100 reactions; PALLADIUM 110/heavy ion fusion reactions; PALLADIUM 110 TARGET/cross sections; PALLADIUM 110 TARGET/palladium 110; COMPARATIVE EVALUATIONS; EXPERIMENTAL DATA; MEV RANGE 100-1000; NUCLEAR POTENTIAL; OPTICAL MODELS

34231 (INIS-RU–347, pp. 371) **Caustic features of wave function of the light ion elastic scattering.** Zagrebaev, V.I. (Chuvashskij Gosudarstvennyj Univ., Cheboksary (Russian Federation)); Semkin, D.N. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. LIGHT IONS/elastic scattering; LIGHT IONS/wave functions; COULOMB FIELD; SINGULARITY; WOODS-SAXON POTENTIAL

34232 (INIS-RU–347, pp. 372) **Exchange correlation function and surface effects.** Knyaz'kov, O.M.; Matusov, Yu.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Targets: ^{20}Ne, ^{26}Mg, ^{40}Ca, ^{58}Ni, ^{90}Zr, ^{100}Mo, ^{120}Sn, ^{208}Pb.

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Short communication. 2 refs. NUCLEAR REACTIONS/correlation functions; DENSITY MATRIX; EXCHANGE INTERACTIONS; HEAVY NUCLEI; INTERACTION RANGE; INTERMEDIATE MASS NUCLEI; LIGHT NUCLEI; NUCLEAR RADII; NUCLEON-NUCLEON POTENTIAL; SURFACE POTENTIAL

34233 (INIS-RU–347, pp. 444) **Study on the ^{16}O(d,p)^{17}O* stripping in the frame of different approaches.** Gurbanovich, I.S. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki). AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. OXYGEN 16 TARGET/deuteron reactions; OXYGEN 16 TARGET/stripping; COUPLED CHANNEL THEORY; DWBA; EXCITED STATES; MEV RANGE 01-10; MULTIPLE SCATTERING; NUCLEAR REACTION KINETICS; STRIPPING; OXYGEN 17; PROTONS

34234 (INIS-RU–347, pp. 452) **Extrapolation of the nuclei interaction cross section in E=0 range.** Lazarev, L.M. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. LITHIUM 7 TARGET/triton reactions; ALPHA PARTICLES; COMPOUND NUCLEI; COULOMB FIELD; CROSS SECTIONS; ERRORS; EXCITED STATES; EXTRAPOLATION; HAUSER-FESHBACH THEORY; HELIUM 6; INTERACTION RANGE; KEV RANGE 10-100; S MATRIX

34235 (INIS-RU–347, pp. 455) **Optical model description of deuteron elastic scattering on ^{9}Be.** Abramovich, S.N.; Generalov, L.N.; Guzhovskij, B.Ya.; Dzyuba, B.M. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs., 1 tab. BERYLLIUM 9 TARGET/deuteron reactions; COULOMB FIELD; CROSS SECTIONS; ELASTIC SCATTERING; L-S COUPLING; MEV RANGE 01-10; MEV RANGE 10-100; NUCLEAR RADII; NUMERICAL DATA; OPTICAL MODELS; WOODS-SAXON POTENTIAL

34236 (LUNFD6-NFFK–1006) **Multiplicities of pions and slow protons in nuclear interactions at relativistic energies.** Idh, J. Lund Univ. (Sweden). Dept. of Cosmic and Subatomic Physics. Feb 1993. 53p. Order Number DE94600403. Source: OSTI; NTIS; INIS.

The distributions of the transverse energy and the multiplicity of charged particles in oxygen induced reactions are examined in the Fritiof Monte Carlo model. The shape of the distributions are found to be determined by the distribution of the number of particle-emitting sources, i.e. strings. The fluctuations in particle emission from each string is hidden by these much larger fluctuations. The fluctuations of these distributions when partial phase space coverage is used is well described by purely stochastic emission. Distributions of slow singly-charged fragments in the target region is measured for both hadron and oxygen induced reactions. The distributions extends to much larger values than simulated data from the Monte Carlo models Fritiof 1.7 and Venus 3.14. The hadron induced reactions give distributions that can be reproduced assuming that each participating target nucleon produced fragments according to a geometric distribution, where the average number of fragments per participating target nucleon is target dependent. The extracted average number of produced fragments are similar for proton and pion induced reactions. When the tails of the distributions are studied their extension can be parametrized, and for such an approach a target dependence of $A^{2/3}$ is found for all projectiles. The data for 60 and 200 A GeV are almost identical for distributions as well as angular and energy examined distributions. The angular distributions follow an exponential in $\cos(\theta)$. If the slopes of the angular distributions are examined and target dependences as well as centrality dependences are extracted. For light targets there is a strong target dependence, but for targets heavier than copper there is not any great differences. The centrality dependence is almost negligible for a gold-target but for a copper-target the most central collisions have more forward peaked distributions. (62 refs.).

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Refer also to citation(s) 34020, 34030, 34040, 34048, 34066, 34068, 34146, 34177, 34211, 34212, 34214, 34229, 34230, 34594

34237 (ANL/EP/CP–79781) **Results from the Argonne, Los Alamos, JAERI collaboration.** Meadows, J. (Argonne National Lab., IL (United States)); Smith, D.; Greenwood, L.; Haight, R.; Ikeda, Y.; Konno, C. Argonne National Lab., IL (United States). [1993]. 24p. Sponsored by USDOE, Washington, DC (United States); International Atomic Energy Agency, Vienna (Austria). DOE Contract W-31109-ENG-38 ;W-7405-ENG-36. Agreement 5064/CF. (CONF-9304181–1: IAEA's coordinated research on

activation cross sections for the generation of long-lived and radionuclides of importance in fusion reactor technology, San Diego, CA (United States), 29-30 Apr 1993). Order Number DE93017745. Source: OSTI; NTIS; INIS; GPO Dep.

Four sample packets containing elemental Ti, Fe, Ni, Cu, Nb, Ag, Eu, Tb and Hf have been irradiated in three distinct accelerator neutron fields, at Argonne National Laboratory and Los Alamos National Laboratory, USA, and Japan Atomic Energy Research Institute, Tokai, Japan. The acquired experimental data include differential cross sections and integral cross sections for the continuum neutron spectrum produced by 7-MeV deuterons incident on thick Be-metal target. The U-238(n,f) cross section was also measured at 10.3 MeV as a consistency check on the experimental technique. This the third progress report on a project which has been carried out under the auspices of an IAEA Coordinated Research Program entitled "Activation Cross Sections for the Generation Of Long-lived Radionuclides of Importance in Fusion Reactor Technology". The present report provides the latest results from this work. Comparison is made between the 14.7-MeV cross-section values obtained from the separate investigations at Argonne and JAERI. Generally, good agreement observed within the experimental errors when consistent sample parameters, radioactivity decay data and reference cross values are employed. A comparison is also made between the experimental results and those derived from calculations using a nuclear model. Experimental neutron information on the Be(d,n) neutron spectrum was incorporated in the comparisons for the integral results. The agreement is satisfactory considering the various uncertainties that are involved.

34238 (BUP–1992-13) **Phase transition dynamics in ultra-relativistic heavy-ion collisions.** Csernai, L.P. (Bergen Univ. (Norway)); Kapusta, J.I.; Kluge, G.Y.; Zabrodin, E.E. Bergen Univ. (Norway). Dept. of Physics. Nov 1992. 25p. Order Number DE94600422. Source: OSTI; NTIS; INIS.

The authors investigate various problems related to the dynamics of a first-order phase transition from quark-gluon plasma to hadronic matter in ultra-relativistic heavy ion collisions. These include nucleation, growth and fusion of hadronic bubbles in either the Bjorken longitudinal hydrodynamic expansion model or the Cooper-Frye-Schonberg spherical hydrodynamic expansion model. With reasonable input parameters the conversion of one phase into the other is relatively close to the idealized adiabatic Maxwell construction, although one can choose parameters such that the conversion is strongly out of equilibrium. 10 refs., 7 figs.

34239 (BUP–1992-14) **Strangeness production in proton and heavy ion collisions at 200 A GeV.** Amelin, N.S. (Univ. of Frankfurt (Germany)); Bravina, L.V.; Csernai, L.P.; Toneev, V.D.; Gudima, K.K.; Sivoklokov, S.Y. Bergen Univ. (Norway). Dept. of Physics. Nov 1992. 27p. Order Number DE94600423. Source: OSTI; NTIS; INIS.

Strangeness production at SPS-CERN energies is studied within the Quark Gluon String Model. The observed shape of rapidity and transverse mass distributions are reproduced fairly well for both peripheral and central heavy ion collisions. However, for central collisions the model underpredicts strange particle abundances by a factor of about 2:2:4 for K_S^0, Λ and antiΛ, respectively. This discrepancy can be considered as a possible manifestation of collective string-string interactions similar to the formation of a color rope. Model predictions for coming experiments with the Pb beam at CERN are given. 30 refs. 11 figs., 3 tabs.

34240 (BUP–1992-16) **Direct experimental evidence for a soft dipole response in ^{6}He.** Sakuta, S.B. (Kurchatov Inst., Moscow (Russian Federation)); Ershov, S.N.; Vaagen, J.S. Russian - Nordic - British Theory Collaboration (RNBT). Bergen Univ. (Norway). Dept. of Physics. Dec 1992. 10p. Order Number DE94600421. Source: OSTI; NTIS; INIS.

The differential cross sections of the charge-exchange reaction ^{6}Li(^{7}Li,^{7}Be)^{6}He were measured at beam energies 78 and 82 MeV. In addition to the 0^+ bound state and sharp 2^+ resonance, three wide bumps were identified in the experimental continuum spectrum of ^{7}Be at small angles. The maximum at excitation energy of $\approx$ 6MeV is consistent with a soft dipole response, expected in nuclei with neutron halo. 23 refs., 2 figs.

34241 (CONF-9210173–7) **Computer codes for checking, plotting and processing of neutron cross-section covariance data and their application.** Sartori, E. (OECD/NEA Data Bank, Issy les Moulineaux (France)); Roussin, R.W. Oak Ridge National Lab., TN (United States). [1992]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Nuclear Energy Agency Science Committee (NEANSC) specialists meeting on evaluation and processing of covariance data; Oak Ridge, TN (United States); 7-9 Oct 1992. Order Number DE93018459. Source: OSTI; NTIS; GPO Dep.

This paper presents a brief review of computer codes concerned with checking, plotting, processing and using of covariances of neutron cross-section data. It concentrates on those available from the computer code information centers of the United States and the OECD/Nuclear Energy Agency. Emphasis will be placed also on codes using covariances for specific applications such as uncertainty analysis, data adjustment and data consistency analysis. Recent evaluations contain neutron cross section covariance information for all isotopes of major importance for technological applications of nuclear energy. It is therefore important that the available software tools needed for taking advantage of this information are widely known as hey permit the determination of better safety margins and allow the optimization of more economic, I designs of nuclear energy systems.

34242 (CONF-9301109–4) **Experimental overview.** Plasil, F. Oak Ridge National Lab., TN (United States). [1993]. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 2. international conference on physics and astrophysics of quark-gluon plasma; Calcutta (India); 19-23 Jan 1993. Order Number DE93018719. Source: OSTI; NTIS; INIS; GPO Dep.

Data from CERN/SPS and BNL/AGS experiments were reviewed, with emphasis on most recent results, including reactions with recently obtained Au ions.

34243 (DOE/ER/40531–4) **Heavy-ion collisions and the nuclear equation of state: Progress report, August 15, 1992–April 1993.** Keane, D. Kent State Univ., OH (United States). Dept. of Physics. [1993]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-89ER40531. Order Number DE93019263. Source: OSTI; NTIS; INIS; GPO Dep.

The overall goal of this project is to study nucleus-nucleus collisions experimentally at intermediate and relativistic energies, with emphasis on measurement and interpretation of correlation effects that provide insight into the nuclear phase diagram and the nuclear equation of state. During the course of this reporting period, the PI returned to Kent from a 15-month leave at Lawrence Berkeley Lab, which had been devoted 100% to work on this research project. The EOS Time Projection Chamber at LBL's Bevalac accelerator has continued to be the major focus of research for all of the supported personnel; about a year ago, this detector successfully took data in production mode for the first time, and accumulated in excess of 1000 hours of beam time before the termination of the Bevalac in February 1993. Reduction and analysis of these data is currently our first priority. Effort has also been devoted to the STAR detector at the Relativistic Heavy Ion Collider, in the form of contributions to the Conceptual Design Report, work on HV control hardware and software for use with the STAR Time Projection Chamber, and tracking software development.

34244 (INIS-RU–347, pp. 43) **Investigation of slowing-down processes of nuclear recoil in matter at small energies (<1 keV).** Kondrat'ev, V.N. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Kravets, N.S.; Kupryashkin, V.T.; Stril'chuk, N.V.; Feoktistov, A.I.; Shapovalova, I.P. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. NEUTRON REACTIONS/recoils; DSA METHOD; EV RANGE; GAMMA RADIATION; RECOILS; NUCLEI; SLOWING-DOWN

34245 (INIS-RU–347, pp. 44) **Investigation of slowing-down processes of ^{32}S nuclear recoil in PbS.** Koshutskij, Yu.E. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Kupryashkin, V.T.; Stril'chuk, N.V.; Feoktistov, A.I.; Shapovalova, I.P. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs., 1 tab. NEUTRON REACTIONS/recoils; DSA METHOD; EXPERIMENTAL DATA; GAMMA RADIATION; LEAD SULFIDES; RECOILS; NUCLEI; SLOWING-DOWN

34246 (INIS-RU–347, pp. 46) **Properties of ^{49}Ti excited states from the (n,n'γ) reaction.** Kosyak, Yu.G. (AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki); Chekushina, L.V.; Urikbaeva, G.A.; Lysikov, Yu.A.; Adymov, Zh.I.; Arynov, S. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref., 2 tabs. TITANIUM 48/excited states; EXPERIMENTAL DATA; LEVEL WIDTHS; LIFETIME; NEUTRON REACTIONS; OCCUPATION NUMBER; STATISTICAL MODELS; THEORETICAL DATA; TITANIUM 48 TARGET

34247 (INIS-RU–347, pp. 48) **Occupation of ^{52}Cr levels in the (n,n'γ) reaction with reactor fast neutrons.** Kosyak, Yu.G. (AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki); Chekushina, L.V.; Adymov, Zh.I.; Lysikov, Yu.A.; Arynov, S.; Urikbaeva, G.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs., 1 tab. CHROMIUM 52/energy levels; EXPERIMENTAL DATA; FAST NEUTRONS; INELASTIC SCATTERING; NEUTRON REACTIONS; OCCUPATION NUMBER; STATISTICAL MODELS; THEORETICAL DATA

34248 (INIS-RU–347, pp. 51) **Occupation of ^{77}Se excited states in the (n,n'γ) reaction with reactor fast neutron beam.** Kosyak, Yu.G. (AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki); Chekushina, L.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Theses of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref., 1 tab. SELENIUM 77/excited states; EXPERIMENTAL DATA; INELASTIC SCATTERING; NEUTRON REACTIONS; OCCUPATION NUMBER; STATISTICAL MODELS; THEORETICAL DATA

34249 (INIS-RU–347, pp. 110) **Photodisintegration of ^{236}U nucleus near threshold by linearly polarized photons.** Khvastunov, V.M. (AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst.); Vladimirov, Yu.V.; Denyak, V.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. URANIUM 236 TARGET/photofission; ASYMMETRY; FISSION FRAGMENTS; POLARIZED BEAMS; PHOTOFISSION

34250 (INIS-RU–347, pp. 111) **Yields of rare earth elements in the ^{238}U photofission.** Gangrskij, Yu.P. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Tonchev, P.; Kondev, F.; Marinov, M.; Balabanov, N. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 tab. PHOTOFISSION/fission yield; RARE EARTH NUCLEI/fission products; URANIUM 238/photofission; CERIUM ISOTOPES; EUROPIUM ISOTOPES; EXPERIMENTAL DATA; FISSION FRAGMENTS; GAMMA SPECTROSCOPY; LANTHANUM 140; NEODYMIUM 147; PHOTOFISSION; PROMETHIUM 151; SAMARIUM 153; YTTRIUM 93

34251 (INIS-RU–347, pp. 119) **Gamow-Teller strength functions of odd nuclei with pairing and inverse β-decay process cross sections.** Borzov, I.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (Russian Federation). Fiziko-Ehnergeticheskij Inst.); Trykov, E.L.; Fayans, S.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. GALLIUM 71 TARGET/antineutrino reactions; INDIUM 115 TARGET/antineutrino reactions; ELECTRON ANTINEUTRINOS; GAMOW-TELLER RULES; STRENGTH FUNCTIONS; TOTAL CROSS SECTIONS

34252 (INIS-RU–347, pp. 135) **Fragmentation of the Gamow-Teller β^--transitions in the Wigner scheme.** Yankauskas, K.I.; Bondarenko, V.M.; Petrauskas, A.K. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs., 1 tab. MAGNESIUM 26 TARGET/proton reactions; ALUMINIUM 26; BETA-MINUS DECAY; GAMOW-TELLER RULES; ISOSPIN; MATRIX ELEMENTS; MULTIPLETS; NEUTRONS; SUPERSYMMETRY; THEORETICAL DATA

34253 (INIS-RU–347, pp. 159) **Angular dependence of the ^{6}Li(2.18 MeV, 3$^+$) nucleus polarization in the 80 MeV α-particles inelastic scattering.** Kozyr', Yu.E. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij). AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. ALPHA REACTIONS/inelastic scattering; LITHIUM 6 TARGET/alpha reactions; ALPHA PARTICLES; EXCITED STATES

34254 (INIS-RU–347, pp. 175) **Spin-neutrino angular correlations at muon capture in ^{28}Si.** Egorov, V.G. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Brudanin, V.B.; Vorobel, V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 4 refs., 1 fig. SILICON 28/gamma radiation; SILICON 28/muonic atoms; CAPTURE; CORRELATIONS; FORM FACTORS; LEVEL WIDTHS; LIFETIME; MUON NEUTRINOS; MUON REACTIONS; SILICON 28 TARGET

34255 (INIS-RU–347, pp. 178) **Estimation of (A,Z)(ν_e,e^-)(A,Z+1) reaction cross section.** Lyutostanskij, Yu.S. (Moskovskij Inzhenerno-Fizicheskij Inst., Moscow (Russian Federation)); Panov, I.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 5 refs. CHLORINE 37 TARGET/neutrino reactions; GERMANIUM 71 TARGET/neutrino reactions; IODINE 127 TARGET/neutrino reactions; CROSS SECTIONS; ELECTRON NEUTRINOS; ELECTRONS; MATRIX ELEMENTS; NEUTRINO DETECTION

34256 (INIS-RU–347, pp. 199) **Bremsstrahlung of polarized electrons in case of fixed energy transferred to nucleus.** Nadafov, I.M.; Rustamova, G.R. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. ELECTRON REACTIONS/bremsstrahlung; BREMSSTRAHLUNG; ELECTRONS; ENERGY DEPENDENCE; GAMMA RADIATION; NUCLEI; POLARIZED BEAMS; POLARIZED PRODUCTS

34257 (INIS-RU–347, pp. 200) **Interference effects in the process of photoproduction of lepton-antilepton pairs on nuclei anti magnetic moment.** Ablakulov, Kh.A. (AN Uzbekskoj SSR, Tashkent (Uzbekistan). Inst. Yadernoj Fiziki). AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. ANTILEPTONS/pair production; ANTILEPTONS/photoproduction; ANTILEPTONS; PHOTOPRODUCTION; DIFFERENTIAL CROSS SECTIONS; LEPTONS; LITHIUM 7 TARGET; NUCLEAR MAGNETIC MOMENTS; ORIENTED NUCLEI; POLARIZED BEAMS; POLARIZED PRODUCTS; TOTAL CROSS SECTIONS

34258 (INIS-RU–347, pp. 204) **Partial cross sections for the ^{45}Sc(p,γ)^{46}Ti reaction at low energy of protons.** Zalyubovskij, I.I.; Nemashkalo, B.A.; Ratkekvich, S.S.; Fedorets, I.D.; Shebeko, K.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. 1 ref. SCANDIUM 45 TARGET/proton reactions; CROSS SECTIONS; ENERGY DEPENDENCE; ENERGY-LEVEL TRANSITIONS; GAMMA RADIATION; MEV RANGE 01-10; THICKNESS; TITANIUM 46

34259 (INIS-RU–347, pp. 205) **Cross sections for the (p,γ0,1,2) reaction on ^{65}Cu near the threshold of neutron emission.** Nemashkalo, B.A.; Shebeko, K.B.; Utenkov, S.N. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. COPPER 65 TARGET/proton reactions; CROSS SECTIONS; ENERGY DEPENDENCE; GAMMA RADIATION; MEV RANGE 01-10; OCCUPATION NUMBER; STATISTICAL MODELS; THRESHOLD ENERGY; ZINC 66

34260 (INIS-RU–347, pp. 206) **Radiative proton capture by ^{69}Ga nuclei.** Nemashkalo, B.A.; Shabeko, K.V.; Utenkov, S.N.; Kozlov, A.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. GALLIUM 69 TARGET/proton reactions; PROTON REACTIONS/capture; CROSS SECTIONS; ENERGY-LEVEL TRANSITIONS; EXCITED STATES; GAMMA RADIATION; GROUND STATES; CAPTURE

34261 (INIS-RU–347, pp. 207) **Partial cross sections of the (p,n) reaction on ^{71}Ga.** Fedorets, I.D.; Zalyubovskij, I.N.; Ratkevich, S.S.; Nemashkalo, B.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. GALLIUM 71/excited states; GALLIUM 71 TARGET/proton reactions; CROSS SECTIONS; GAMMA SPECTRA; MEV RANGE 01-10; NEUTRONS; PARITY; SPIN

34262 (INIS-RU–347, pp. 208) **Energy dependence pf (antip,p')-scattering on Si with excitation of 2^+ and 3^- (T=0) states.** Plavko, A.V. (Leningradskij Gosudarstvennyj Univ., Leningrad (Russian Federation)); Kudryashov, V.I.; Olmer, K.; Shvandt, P. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. SILICON 28 TARGET/proton reactions; DIFFERENTIAL CROSS SECTIONS; ENERGY DEPENDENCE; EXCITED STATES; MEV RANGE 100-1000; MOMENTUM TRANSFER; NUCLEON-NUCLEON INTERACTIONS; POLARIZATION-ASYMMETRY RATIO; POLARIZED BEAMS; PROTONS

34263 (INIS-RU–347, pp. 209) **Surface and inner excitation of 2^+ states in ^{28}Si in inelastic proton scattering.** Plavko, A.V. (Leningradskij Gosudarstvennyj Univ., Leningrad (Russian Federation)); Onegin, M.S.; Kaurov, V.N.; Olmer, K.; Shvandt, P. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. SILICON 28/excited states; SILICON 28 TARGET/proton reactions; ANGULAR DISTRIBUTION; DIFFERENTIAL CROSS SECTIONS; INELASTIC SCATTERING; MEV RANGE 100-1000; NUCLEON-NUCLEON INTERACTIONS; PROTONS

34264 (INIS-RU–347, pp. 210) **Quasivibrational and nonvibrational 4^+ states of ^{56}Fe in the (antip,p') scattering at e_p=16 MeV.** Plavko, A.V. (Leningradskij Gosudarstvennyj Univ., Leningrad (Russian Federation)); Kudryashov, V.I.; Klegg, T.; Karvovski, Kh.; Varner, R.L. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. IRON 56/vibrational states; IRON 56 REACTIONS; MEV RANGE 01-10; MEV RANGE 10-100; POLARIZATION-ASYMMETRY RATIO; POLARIZED BEAMS; PROTON REACTIONS; PROTONS; SCATTERING

34265 (INIS-RU–347, pp. 213) **Excitation functions of the (p,n) reaction on zinc isotopes in the energy range E_p 4.9-5.9 MeV.** Vinogradov, V.M. (Leningradskij Gosudarstvennyj Univ., Leningrad (Russian Federation)); Zhuravlev, Yu.Yu.; Zarubin, P.P.; Kolozhvari, A.A.; Sergeev, V.O.; Sitnikova, I.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. ZINC 68 TARGET/proton reactions; ZINC 69/isobaric analogs; ZINC 70 TARGET/proton reactions; ZINC 71/isobaric analogs; EXCITATION FUNCTIONS; GAMMA SPECTRA; MEV RANGE 01-10; NEUTRONS; RESONANCE; TOTAL CROSS SECTIONS

34266 (INIS-RU–347, pp. 214) **Total cross sections from the (p,n) reaction on molybdenum isotopes at E_p=5-6 MeV.** Antropov, A.E. (Leningradskij Gosudarstvennyj Univ., Leningrad (Russian Federation)); Gusev, V.P.; Zhuravlev, Yu.Yu.; Zarubin, P.P.; Kolozhvari, A.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. MOLYBDENUM 94 TARGET/proton reactions; MOLYBDENUM 95 TARGET/proton reactions; MOLYBDENUM 96 TARGET/proton reactions; PROTON REACTIONS/total cross sections; ENERGY DEPENDENCE; GAMMA SPECTRA; MEV RANGE 01-10; NEUTRONS

34267 (INIS-RU–347, pp. 215) **Study of anomalous proton optical potential near Fermi energy.** Romanovskij, E.A. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Rafu, L.M.; Bespalova, O.V.; Belal', A.; Bogdanov, R.I. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. INTERMEDIATE MASS NUCLEI/proton reactions; PROTON REACTIONS/tin isotopes

34268 (INIS-RU–347, pp. 216) **Investigation of isotopic and shell effects in total cross sections of proton reactions.** Romanovskij, E.A. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Rafu, L.M.; Belal', A.; Bespalova, O.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. INTERMEDIATE MASS NUCLEI/proton reactions; PROTON REACTIONS/total cross sections

34269 (INIS-RU–347, pp. 217) **The role of final-state interaction of n+d subsystem in deuterium breakup reaction on deuterons at 13.6 MeV.** Sokolov, M.V. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij). AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. DEUTERIUM TARGET/deuteron reactions; DEUTERON REACTIONS/breakup reactions; PROTONS

34270 (INIS-RU–347, pp. 218) **Study of relative neutron and proton yields in the (p,pn) and (p,2p) reactions.** Voloshin, N.I.; Palkin, G.P.; Fursa, A.D.; Shostak, V.B. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. HELIUM 4 TARGET/proton reactions; PROTON REACTIONS/knock-out reactions; PROTON REACTIONS/nuclear reaction yield; HELIUM 3

34271 (INIS-RU–347, pp. 219) **On the mechanism of inelastic scattering according to the data on occupation probability of 2_1^+ level substates in the ^{24}Mg(p,p') reaction near resonance at E_p=5.903 MeV.** Lazarev, V.V. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Chubigskij, O.V.; Vinogradov, L.I. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. MAGNESIUM 24 TARGET/proton reactions; PROTON REACTIONS/elastic scattering; PROTON REACTIONS/inelastic scattering

34272 (INIS-RU–347, pp. 220) **Isotopic dependence of cross sections of neutron scattering on Ge and Se even isotopes.** Musaehlyan, R.M.; Popov, V.I.; Skorkin, V.M.; Surkova, I.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. GERMANIUM ISOTOPES/neutron reactions; NEUTRON REACTIONS/elastic scattering; NEUTRON REACTIONS/inelastic scattering; SELENIUM ISOTOPES/neutron reactions; OPTICAL MODELS

34273 (INIS-RU–347, pp. 221) **Comparison of two examples of a generalized optical model in the analysis of neutron cross sections for Te.** Musaehlyan, R.M.; Skorkin, V.M.; Surkova, I.V.; Yakovenko, T.I. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. NEUTRON REACTIONS/elastic scattering; NEUTRON REACTIONS/optical models; TELLURIUM ISOTOPES/neutron reactions; DIFFERENTIAL CROSS SECTIONS; TOTAL CROSS SECTIONS

34274 (INIS-RU–347, pp. 222) **On the mechanism of a regular spin splitting of cross sections and the Te(n,p)m Sn(p,n) reaction cross sections.** Gopych, P.M.; Sorokin, V.I. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 4 refs. NEUTRON REACTIONS/cross sections; PROTON REACTIONS/cross sections; TELLURIUM/neutron reactions; TIN ISOTOPES/proton reactions; MASS NUMBER; PARITY; TARGETS; TELLURIUM

34275 (INIS-RU–347, pp. 223) **Momentum transfer in mean energy proton reactions with heavy nuclei.** Gorshkov, T.Yu. (Radievyj Inst., Leningrad (Russian Federation)); D'yachenko, A.T.; Prokof'ev, A.V.; Smirnov, A.N.; Ehjsmont, V.P. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. PROTON REACTIONS/fission; THORIUM 232 TARGET/proton reactions; URANIUM 233 TARGET/proton reactions; URANIUM 235 TARGET/proton reactions; URANIUM 238 TARGET/proton reactions; ENERGY DEPENDENCE; EXPERIMENTAL DATA; FISSION

34276 (INIS-RU–347, pp. 224) **Study of P-even angular asymmetry of ^{235}U fission fragments spread relatively to the direction of a slow neutron beam in the energy range 1 to 136 eV.** Gagarskij, A.M. (AN SSSR, Leningrad (Russian Federation). Inst. Yadernoj Fiziki); Golosovskij, S.P.; Laptev, A.B.; Petrov, G.A.; Petukhov, A.K.; Plava, Yu.S.; Sokolov, V.E.; Shcherbakov, O.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. NEUTRON REACTIONS/capture; NEUTRON REACTIONS/fission; URANIUM 235 TARGET/neutron reactions; CAPTURE; FISSION; P WAVES; S WAVES; SLOW NEUTRONS

34277 (INIS-RU–347, pp. 225) **Fission isomer yield in the (n,n') and (n,γ) reactions on ^{241}Am.** Makarenko, V.E.; Molchanov, Yu.D.; Otroshchenko, G.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. AMERICIUM 241 TARGET/fission isomers; AMERICIUM 241 TARGET/neutron reactions; NEUTRON REACTIONS/fast fission; NEUTRON REACTIONS/spontaneous fission; FISSION FRAGMENTS

34278 (INIS-RU–347, pp. 226) **Interaction of K$^+$-mesons with nucleus and nuclei at energies below 1 GeV.** Berdnikov, Ya.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. KAON PLUS REACTIONS/nuclear fragmentation; KAON-NUCLEON INTERACTIONS; ELASTIC SCATTERING; INTEGRAL CROSS SECTIONS; MEV RANGE 100-1000; NUCLEAR POTENTIAL; SCATTERING AMPLITUDES; TOTAL CROSS SECTIONS

34279 (INIS-RU–347, pp. 227) **Study of the (K$^+$,K$_n$) reaction at 60 MeV.** Berdnikov, Ya.A.; Polishchuk, S.N.; Shishlo, A.P. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. KAON PLUS REACTIONS/distorted wave theory; KAON PLUS REACTIONS/integral cross sections; IMPULSE APPROXIMATION; KAONS PLUS; MEV RANGE 10-100; NEUTRONS; NUCLEAR EMULSIONS

34280 (INIS-RU–347, pp. 228) **Elastic scattering of p^{11}Li at intermediate energies.** Alkhazov, G.D. (AN SSSR, Leningrad (Russian Federation). Inst. Yadernoj Fiziki); Lobodenko, A.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. LITHIUM 11 REACTIONS/proton reactions; CROSS SECTIONS; ELASTIC SCATTERING; PARTICLE-CORE COUPLING MODEL

34281 (INIS-RU–347, pp. 229) **Study of the dispersion corrections role in the inelastic proton scattering on ^{28}Si at E-p<30 MeV.** Romanovskij, E.A. (Moskovskij Gosudarstvennyj Univ.,

Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Spasskaya, T.I. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253--: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. SILICON 28 TARGET/proton reactions; CORRECTIONS; COUPLED CHANNEL THEORY; CROSS SECTIONS; INELASTIC SCATTERING; MEV RANGE 10-100

34282 (INIS-RU--347, pp. 230) **Reaction mechanisms of inelastic pion-nucleus scattering at intermediate energies.** Lantsev, I.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253--: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. PION PLUS REACTIONS/nuclear reaction kinetics; EXPERIMENTAL DATA; FINAL-STATE INTERACTIONS; INELASTIC SCATTERING; KNOCK-OUT REACTIONS; RESCATTERING

34283 (INIS-RU--347, pp. 231) **(π^-,-x) and (π^-,2px) reactions on C,N,O and Ag, Br at energy of 170 MeV.** Lantsev, I.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253--: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. PION MINUS REACTIONS/cross sections; PION MINUS REACTIONS/nuclear reaction yield; EXPERIMENTAL DATA; MEV RANGE 100-1000

34284 (INIS-RU--347, pp. 232) **Quasi-free capture by clusters and rescattering process in pion-nucleus absorption reactions.** Lantsev, I.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253--: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. PION PLUS REACTIONS/nuclear reaction kinetics; BROMINE; CAPTURE; CARBON; EXPERIMENTAL DATA; FINAL-STATE INTERACTIONS; MEV RANGE 10-100; NITROGEN; OXYGEN; RESCATTERING; SILVER; TOTAL CROSS SECTIONS

34285 (INIS-RU--347, pp. 233) **Differential cross sections of neutron scattering with energy of 70-400 keV and middle parameters of neutron resonances for ^{110,113,116}Cd.** Konobeevskij, E.S.; Mordovskij, V.; Popov, V.I.; Skorkin, V.M.; Surkina, I.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253--: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. CADMIUM 110/excited states; CADMIUM 113/excited states; CADMIUM 116/excited states; NEUTRON REACTIONS/differential cross sections; ELASTIC SCATTERING; MEV RANGE 10-100; MEV RANGE 100-1000

34286 (INIS-RU--347, pp. 234) **Isomer ratios in proton and deuteron reactions.** Zheltonozhskij, V.A.; Reshit'ko, S.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253--: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. DEUTERON REACTIONS/isomer ratio; PROTON REACTIONS/isomer ratio; EXPERIMENTAL DATA; GOLD 197 TARGET; GOLD 198; GROUND STATES; ISOMERIC NUCLEI; MEV RANGE 01-10; MEV RANGE 10-100; PLATINUM 198 TARGET

34287 (INIS-RU--347, pp. 235) **Isomer ratio dependence on neutron energy in the ^{197}Au(n,γ)$^{198m'g}$Au.** Zheltonozhskij, V.A.; Litvinskij, L.L.; Majdannik, B.N.; Murzin, A.V.; Reshit'ko, S.V.; Tarakanov, V.K. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253--: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. NEUTRON REACTIONS/isomer ratio; EXPERIMENTAL DATA; GROUND STATES; ISOMERIC NUCLEI

34288 (INIS-RU--347, pp. 236) **Charged particle emission during slow negative pion absorption by uranium nuclei.** Balovitskij, G.E. (AN SSSR, Moscow (Russian Federation). Inst. Yadernykh Issledovanij); Baranov, V.N.; Petman, K. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253--: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. URANIUM/pion minus reactions; ALPHA PARTICLES; ANGULAR DISTRIBUTION; ANISOTROPY; DEUTERONS; PARTICLE PRODUCTION; PROTONS; TRITONS; URANIUM

34289 (INIS-RU--347, pp. 236) **On angular correlations between fragments and charged particles emitted during uranium fission by protons at E_p=153 MeV.** Balovitskij, G.E. (AN SSSR, Moscow (Russian Federation). Inst. Yadernykh Issledovanij); Baranov, V.N. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253--: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. PROTON REACTIONS/fission; URANIUM/proton reactions; ANGULAR CORRELATION; CHARGED PARTICLES; FISSION FRAGMENTS; MEV RANGE 100-1000; ORIENTATION; FISSION; URANIUM

34290 (INIS-RU--347, pp. 238) **Pion production in the A(γ,πN)B reaction.** Glavanakov, I.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253--: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. PIONS MINUS/photoproduction; PIONS NEUTRAL/photoproduction; PHOTONUCLEAR REACTIONS; PHOTOPRODUCTION

34291 (INIS-RU–347, pp. 239) **Study of the $^{12}(\gamma,\pi^-p)$ reaction in a wide range of kinematic variable variations.** Glavanakov, I.V. (and others); Krechetov, Yu.F.; Moiseenko, A.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. CARBON 12 TARGET/photonuclear reactions; ANGULAR DISTRIBUTION; DIFFERENTIAL CROSS SECTIONS; MEV RANGE 100-1000; PIONS MINUS; PROTONS

34292 (INIS-RU–347, pp. 241) **Analysis and estimation of photonuclear reactions on copper isotopes.** Varlamov, V.V. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Efimkin, N.G.; Siepanov, M.E. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. COPPER 63 TARGET/photonuclear reactions; COPPER 65 TARGET/photonuclear reactions; EXPERIMENTAL DATA; INTEGRAL CROSS SECTIONS; MEV RANGE 10-100

34293 (INIS-RU–347, pp. 243) **On the problem of isomer ratios in the (γ,γ') reaction in the 4-9 MeV range.** Mazur, V.M. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Sokolyuk, I.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 4 refs. PHOTONUCLEAR REACTIONS/isomer ratio; EXPERIMENTAL DATA; INTERMEDIATE MASS NUCLEI; MEV RANGE 01-10

34294 (INIS-RU–347, pp. 244) **Formula for isomer ratios.** Mazur, V.M.; Lendel, A.I.; Bigan, Eh.M.; Bokhinyuk, V.S.; Goshovskij, M.V.; Chichura, I.I. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. PHOTONUCLEAR REACTIONS/isomer ratio; EXPERIMENTAL DATA; INTERMEDIATE MASS NUCLEI; NUCLEAR REACTION YIELD; THRESHOLD ENERGY

34295 (INIS-RU–347, pp. 245) **Isomer ratio of the $^{118}Sn(\gamma,p)^{117m,g}In$.** Beseda, I.Z.; Bigan, Z.M.; Bokhinyuk, V.S.; Mazur, V.M.; Sabolchij, N.T.; Sokolyuk, I.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 5 refs. TIN 118 TARGET/photonuclear reactions; EXPERIMENTAL DATA; ISOMERIC NUCLEI; MEV RANGE 10-100; NUCLEAR REACTION YIELD

34296 (INIS-RU–347, pp. 246) **Excitation of the 11/2$^-$ isomeric state for ^{143}Sm in the (γ,n) reaction.** Zheltonozhskij, V.A. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Mazur, V.M.; Bigan, Z.M.; Sychev, S.I.; Chichura, I.I. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. SAMARIUM 143/energy-level transitions; SAMARIUM 144 TARGET/photonuclear reactions; CROSS SECTIONS; EXPERIMENTAL DATA; ISOMER RATIO; ISOMERIC NUCLEI; NUCLEAR REACTION YIELD

34297 (INIS-RU–347, pp. 247) **Dipole giant resonance over the first excited state of ^{12}C.** Ishkhanov, V.S. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Orlin, V.N.; Sapunenko, V.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. CARBON 12/excited states; CARBON 12 TARGET/photonuclear reactions; BORON 11; CROSS SECTIONS; ENERGY DEPENDENCE; GIANT RESONANCE; PROTONS

34298 (INIS-RU–347, pp. 248) **Photoexcitation of the ^{190m}Os and ^{203}Pb in the 8-11 MeV range of γ-quanta.** Balabanov, N.P. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Belov, A.G.; Gangrskij, Yu.P.; Konder, F.G.; Tonchev, A.P. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. LEAD 204/energy-level transitions; OSMIUM 190/energy-level transitions; LEAD 204 TARGET; MEV RANGE 01-10; OSMIUM 190 TARGET; PHOTONUCLEAR REACTIONS

34299 (INIS-RU–347, pp. 249) **Structure of the (γ,n) reaction cross section on ^{142}Nd.** Belyaev, S.N. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Vasil'ev, O.V.; Voronov, V.V.; Nechkin, A.A.; Ponomareva, V.Yu.; Semenov, V.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. NEODYMIUM 142 TARGET/photonuclear reactions; CROSS SECTIONS; INTERMEDIATE STRUCTURE; MEV RANGE 10-100; QUASIPARTICLE-PHONON MODEL; THRESHOLD ENERGY

34300 (INIS-RU–347, pp. 250) **Structure of the (γ,n) cross sections on ^{90}Zr.** Belyaev, S.N.; Vasil'ev, O.V.; Nechkin, A.A.; Semenov, V.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. ZIRCONIUM 90 TARGET/photonuclear reactions; CROSS SECTIONS; ENERGY DEPENDENCE; GIANT RESONANCE; LEVEL WIDTHS; THEORETICAL DATA

34301 (INIS-RU–347, pp. 251) **Structure of the (γ,n) cross section on ^{116}Sn.** Belyaev, S.N.; Vasil'ev, O.V.; Nechkin, A.A.; Semenov, V.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. TIN 116 TARGET/photonuclear reactions; CROSS SECTIONS; ENERGY DEPENDENCE; GIANT RESONANCE; LEVEL WIDTHS; THEORETICAL DATA

34302 (INIS-RU–347, pp. 252) **Interference effects in the γ^{6}Li->αd reactions.** Burkova, N.A. (and others); Zhaksybekova, K.A.; Zhusupov, M.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. LITHIUM 6 TARGET/photonuclear reactions; ALPHA PARTICLES; DEUTERONS; DIFFERENTIAL CROSS SECTIONS; INTERFERENCE; RESONANCE

34303 (INIS-RU–347, pp. 252) **Mechanisms of the ^{3}He, ^{6}Li and (^{4}He, ^{7}Be) reactions on the ^{16}O and ^{28}Si.** Mashkarov, Yu.G. (and others); Koshchij, E.I. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. ALPHA REACTIONS/elastic scattering; ALPHA REACTIONS/pickup reactions; ALPHA REACTIONS/stripping; LITHIUM 7 TARGET/alpha reactions; STRIPPING

34304 (INIS-RU–347, pp. 253) **Photonuclear reactions: energy resolution and cross section structure.** Varlamov, V.V. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Efimkin, N.G.; Ishkhanov, B.S. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. LEAD 208 TARGET/photonuclear reactions; CROSS SECTIONS; ENERGY DEPENDENCE; ENERGY RESOLUTION

34305 (INIS-RU–347, pp. 254) **Cross section of the ^{113}In (γ,2n) ^{111m,g}In reactions.** Babadzhanov, R.D. (and others). AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. INDIUM 113 TARGET/photonuclear reactions; CROSS SECTIONS; EXPERIMENTAL DATA; INDIUM 111; ISOMERIC NUCLEI

34306 (INIS-RU–347, pp. 255) **Isomer ratios of ^{98}Mo(γ,p) ^{97m,g}Nb reaction yield.** Babadzhanov, R.D. (and others). AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. MOLYBDENUM 98 TARGET/photonuclear reactions; EXPERIMENTAL DATA; GROUND STATES; ISOMER RATIO; ISOMERIC NUCLEI; MEV RANGE 10-100; NIOBIUM 97

34307 (INIS-RU–347, pp. 256) **Isomeric ratios of the ^{96}Mo(γ,p) ^{95m,g}Nb reaction.** Babadzhanov, R.D.; Palvanov, S.R.; Tadzhibaev, G.Yu.; Razhabov, O. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. MOLYBDENUM 96 TARGET/photonuclear reactions; NIOBIUM 95/isomer ratio; NIOBIUM 95/nuclear reaction yield

34308 (INIS-RU–347, pp. 257) **Photonuclear reactions of (γ,pxn) type on ^{112}^{8}Sn nucleus.** Arakelyan, A.A.; Aleksandryan, V.Eh.; Danagulyan, A.S. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. RHODIUM 101/isomer ratio; RHODIUM 102/isomer ratio; TIN 118 TARGET/photonuclear reactions; EXPERIMENTAL DATA; GEV RANGE 01-10; INDIUM ISOTOPES; NEUTRONS; PROTONS

34309 (INIS-RU–347, pp. 258) **Form factor of the ^{7}Li (α,α')^{7}Li (4.63 MeV, 7/2^{-}) inelastic scattering.** Kozyr', Yu.E. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij). AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. ALPHA REACTIONS/form factors; LITHIUM 7 TARGET/alpha reactions; LITHIUM 7 TARGET/inelastic scattering; SHELL MODELS

34310 (INIS-RU–347, pp. 260) **Elastic scattering ^{12}C ^{4}He,^{4}He^{12}CV at E$_{\alpha}$=72 and 81 MeV.** Zayats, I.Yu. (AN Ukrainskoj

SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Gorbunov, O.Yu.; Rudchik, A.T.; Shvedov, A.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. ALPHA REACTIONS/elastic scattering; CARBON 12 TARGET/alpha reactions; ENERGY DEPENDENCE; MEV RANGE 10-100

34311 (INIS-RU–347, pp. 261) **Heavy cluster transfer in the $^{12}C,(^{4}He, ^{12}C^{*})^{4}He$ reactions.** Dem'yanova, A.S. (and others). AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. ALPHA REACTIONS/many-nucleon transfer reactions; CARBON 12 TARGET/alpha reactions

34312 (INIS-RU–347, pp. 264) **New mechanism of the large angle scattering.** Dem'yanova, A.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (Russian Federation). Inst. Atomnoj Ehnergii); Ogloblin, A.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. CARBON ISOTOPES/helium 3 reactions; HELIUM 3 REACTIONS/elastic scattering; HELIUM 3 REACTIONS/inelastic scattering; CROSS SECTIONS; MEV RANGE 10-100; TARGETS; TRITONS

34313 (INIS-RU–347, pp. 265) **Observation of rainbow scattering.** Dem'yanova, A.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (Russian Federation). Inst. Atomnoj Ehnergii); Ogloblin, A.A.; Osadchij, O. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. CARBON 13 TARGET/lithium 6 reactions; LITHIUM 6 REACTIONS/elastic scattering; ANGULAR DISTRIBUTION; DIFFERENTIAL CROSS SECTIONS

34314 (INIS-RU–347, pp. 266) **Backward scattering in the region of the deep rainbow shadow.** Dem'yanova, A.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (Russian Federation). Inst. Atomnoj Ehnergii); Ogloblin, A.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. CARBON 12 TARGET/helium 3 reactions; CARBON 13 TARGET/helium 3 reactions; CARBON 14 TARGET/helium 3 reactions; DIFFERENTIAL CROSS SECTIONS; FORM FACTORS; INELASTIC SCATTERING; MEV RANGE 10-100; TRITONS

34315 (INIS-RU–347, pp. 267-268) **Investigation of the α-particles and ^{3}He ion scattering on the ^{24}Hg, ^{28}Si, ^{30}Si, ^{31}P, ^{32}S.** Adodin, V.V. (and others); Basybekov, K.B.; Burtebaev, N.T. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 6 refs. MAGNESIUM 24 TARGET/alpha reactions; MAGNESIUM 24 TARGET/helium 3 reactions; PHOSPHORUS 31 TARGET/alpha reactions; PHOSPHORUS 31 TARGET/helium 3 reactions; SILICON 28 TARGET/alpha reactions; SILICON 28 TARGET/helium 3 reactions; SILICON 30 TARGET/alpha reactions; SILICON 30 TARGET/helium 3 reactions; SULFUR 32 TARGET/alpha reactions; SULFUR 32 TARGET/helium 3 reactions; EXPERIMENTAL DATA; NUCLEAR DEFORMATION

34316 (INIS-RU–347, pp. 270) **Investigation of the $(^{3}He,\alpha)$ reaction on the ^{30}Si, ^{31}P, ^{32}S nuclei at 60 MeV.** Adonin, V.V. (and others); Basybekov, K.B.; Burgebaev, N.T. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. PHOSPHORUS 31 TARGET/helium 3 reactions; SILICON 30 TARGET/helium 3 reactions; SULFUR 32 TARGET/helium 3 reactions; DIFFERENTIAL CROSS SECTIONS; MEV RANGE 10-100

34317 (INIS-RU–347, pp. 271) **Peculiarities of refractive and diffractive contributions to cross sections of the α-particles elastic rainbow scattering by deformed nuclei.** Kuznichenko, A.V.; Molev, A.S.; Onishchenko, G.M. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. ALPHA REACTIONS/elastic scattering; MAGNESIUM 24 TARGET/alpha reactions; ABSORPTION; REFRACTION; SCATTERING AMPLITUDES

34318 (INIS-RU–347, pp. 272) **On the mechanism of α-particle scattering by ^{16}O nuclei at E_{α}=25 MeV.** Ignatenko, A.V. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Lebedev, V.M.; Orlov, N.V.; Spasskij, A.V.; Teplov, I.B. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. ALPHA REACTIONS/elastic scattering; ALPHA REACTIONS/inelastic scattering; OXYGEN 16 TARGET/alpha reactions; EXCITED STATES; GAMMA RADIATION; OCCUPATION NUMBER

34319 (INIS-RU–347, pp. 272) **Total cross sections of the ^{3}He reactions with nuclei.** Domnikov, V.N. (and others); Dubar, L.V.; Eleukenov, D.Sh. AN SSSR, Moscow (Russian Federation);

AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 5 refs. BISMUTH 209 TARGET/helium 3 reactions; IRON 54 TARGET/helium 3 reactions; IRON 58 TARGET/helium 3 reactions; LEAD 208 TARGET/helium 3 reactions; NICKEL 58 TARGET/helium 3 reactions; NICKEL 64 TARGET/helium 3 reactions; EXPERIMENTAL DATA

34320 (INIS-RU–347, pp. 273) **Collective excitation mechanism in α-particle inelastic scattering by ^{12}C nuclei at E_α=25 MeV.** Orlova, N.V. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Lebedev, V.M.; Spasskij, A.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. ALPHA REACTIONS/coupled channel theory; ALPHA REACTIONS/inelastic scattering; CARBON 12 TARGET/alpha reactions; COLLECTIVE EXCITATIONS; DENSITY MATRIX; OPTICAL MODELS

34321 (INIS-RU–347, pp. 274) **Experimental investigation of the $^{19}F(\alpha,t)^{20}Ne$ reaction mechanism by means of α-γ correlations.** Ignatenko, A.V. (and others); Lebedev, V.M.; Orlov, N.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. ALPHA REACTIONS/nuclear reaction kinetics; FLUORINE 19 TARGET/alpha reactions; DENSITY MATRIX; EXCITED STATES; GROUND STATES; MEV RANGE 10-100; OCCUPATION NUMBER

34322 (INIS-RU–347, pp. 275) **Excitation functions for the $^{22,24}Na$ and ^{7}Be isotopes in ^{3}He ion interaction with Si nuclei at energies up to 95 MeV.** Vysotskij, O.N. (and others); Gajdenko, S.A.; Gonchar, A.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. BERYLLIUM 7/excitation functions; SILICON ISOTOPES/helium 3 reactions; SODIUM 22/excitation functions; SODIUM 24/excitation functions; CROSS SECTIONS; EXPERIMENTAL DATA; GAMMA RADIATION

34323 (INIS-RU–347, pp. 276) **Integral cross sections of the ^{3}He reaction on the $^{50,58}Fe$ and $^{58,64}Ni$ isotopes at 95 MeV.** Domnikov, V.N. (and others); Dubar, L.V.; Eleukenov, D.Sh. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. IRON 54 TARGET/helium 3 reactions; IRON 58 TARGET/helium 3 reactions; NICKEL 58 TARGET/helium 3 reactions; NICKEL 64 TARGET/helium 3 reactions; EXPERIMENTAL DATA; MEV RANGE 10-100; TOTAL CROSS SECTIONS

34324 (INIS-RU–347, pp. 278) **Emission of α-particles and nucleons in deuteron interaction with Zr nuclei.** Gonchar, A.V. (and others); Kondrat'ev, S.N.; Nevskij, S.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. ZIRCONIUM ISOTOPES/deuteron reactions; ALPHA PARTICLES; CROSS SECTIONS; EXCITATION FUNCTIONS; MEV RANGE 10-100; NEUTRONS; NIOBIUM ISOTOPES; TARGETS; YTTRIUM ISOTOPES

34325 (INIS-RU–347, pp. 279) **One-nucleon transfer reaction on the ^{94}Zr and ^{96}Zr isotopes.** Gonchar, A.V. (and others); Kondrat'ev, S.N.; Lobach, Yu.N. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. DEUTERON REACTIONS/one-nucleon transfer reactions; ZIRCONIUM 94 TARGET/deuteron reactions; ZIRCONIUM 96 TARGET/deuteron reactions; CROSS SECTIONS; NIOBIUM ISOTOPES; ZIRCONIUM ISOTOPES

34326 (INIS-RU–347, pp. 280) **(α,xn) reactions on ^{124}Sn isotope.** Gonchar, A.V. (and others); Kondrat'ev, S.N.; Lobach, Yu.N. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. TIN 124 TARGET/deuteron reactions; ANTIMONY ISOTOPES; ENERGY DEPENDENCE; EVAPORATION MODEL; EXPERIMENTAL DATA; MEV RANGE 10-100; NEUTRONS; THEORETICAL DATA

34327 (INIS-RU–347, pp. 281) **Excitation functions of the ^{209}Bi,(d,xn) and ^{209}Bi (d,pxn) reactions.** Gonchar, A.V. (and others); Kondrat'ev, S.N.; Lobach, Yu.N. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. BISMUTH 209 TARGET/deuteron reactions; DEUTERON REACTIONS/cross sections; ENERGY DEPENDENCE; EXCITATION FUNCTIONS; MEV RANGE 10-100; NEUTRONS; PROTONS

34328 (INIS-RU–347, pp. 282) **On the contribution nuclear unbound states of the $^{6}LI^{*}$ in the inclusive deuteron spectra from (α,d) reactions on ^{3}He and ^{3}He nuclei.** Gorpinich, O.K.; Pavlenko, Yu.N.; Povoroznik, O.M.; Struzhko, B.G. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and

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Short communication. 3 refs. HELIUM 3 TARGET/alpha reactions; LITHIUM 6/excited states; TRITIUM TARGET/alpha reactions; ALPHA PARTICLES; CORRELATIONS; DEUTERON SPECTRA

34329 (INIS-RU–347, pp. 283) **Ratios of decay probabilities of ^{8}Be* high-excited states in the ^{10}B(d,α)2α and ^{10}B(d,α)p, ^{7}Li reactions.** Vasil'ev, Yu.N. (and others); Kiva, V.A.; Medvedev, V.I. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. BERYLLIUM 8/excited states; BERYLLIUM 8/nuclear decay; BORON 10 TARGET/deuteron reactions; EXPERIMENTAL DATA; PROBABILITY

34330 (INIS-RU–347, pp. 284) **Vertex constants and spectroscopic factors from the ^{3}He,d reaction analysis on the ^{9}Be and ^{11}B nuclei.** Artemov, S.V. (and others); Gulamov, I.R.; Zotov, I.Yu. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 4 refs. BERYLLIUM 9 TARGET/helium 3 reactions; BORON 11 TARGET/helium 3 reactions; HELIUM 3 REACTIONS/differential cross sections; ANGULAR CORRELATION; EXPERIMENTAL DATA; SPECTROSCOPIC FACTORS; VERTEX FUNCTIONS

34331 (INIS-RU–347, pp. 285) **^{25}Mg(d,^{6,7}Li) reaction at E_d=13.6 MeV.** Shvedov, A.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 4 refs. DEUTERON REACTIONS/many-nucleon transfer reactions; MAGNESIUM 25 TARGET/deuteron reactions; NEON ISOTOPES

34332 (INIS-RU–347, pp. 286) **Refraction effects in the ^{3}He, ^{3}He,^{3}He' and (^{3}He,α) reactions on ^{30}Si nuclei at E(^{3}He)=60 MeV.** Kuznichenko, A.V. (and others); Molev, A.S.; Onishchenko, G.M. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. HELIUM 3 REACTIONS/elastic scattering; HELIUM 3 REACTIONS/inelastic scattering; SILICON 30 TARGET/helium 3 reactions; ALPHA PARTICLES; DIFFERENTIAL CROSS SECTIONS; HELIUM 3; REFRACTION; S MATRIX; SILICON 29

34333 (INIS-RU–347, pp. 287) **Search for the isotopic effect in the 40 MeV deuteron disintegration in interactions with ^{58}Ni and ^{64}Ni nuclei.** Polyanskij, V.N.; Rudenko, B.A.; Tokarevskij, V.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. DEUTERON REACTIONS/breakup reactions; NICKEL 58 TARGET/deuteron reactions; NICKEL 64 TARGET/deuteron reactions; EXPERIMENTAL DATA

34334 (INIS-RU–347, pp. 288-289) **Analysis of excitation functions of reactions induced by alpha particles on ^{116,117,118,120,124}Sn at 13-24.4 MeV energies.** Antropov, A.E. (and others); Khamid, V.; Smirnov, A.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. ALPHA REACTIONS/excitation functions; CROSS SECTIONS; EXPERIMENTAL DATA; TIN 116 TARGET; TIN 117 TARGET; TIN 118 TARGET; TIN 120 TARGET; TIN 124 TARGET

34335 (INIS-RU–347, pp. 290) **Energy dependence of isomer ratios in the ^{116}Sn(d,n)^{119m,g}Te, ^{117}Sn(α,2n)^{119m,g}Te, ^{118}Sn(d,n)^{121m,g}Te reactions.** Antropov, A.E. (and others); Khamid, V.; Smirnov, A.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. ALPHA REACTIONS/isomer ratio; ALPHA REACTIONS/nuclear reaction yield; ENERGY DEPENDENCE; TELLURIUM 119; TELLURIUM 121; TIN 116 TARGET; TIN 117 TARGET; TIN 118 TARGET

34336 (INIS-RU–347, pp. 291) **Activation of aluminium foils by ^{4}He ions with 25-45 MeV energies.** Karamyan, S.A.; Oganesyan, Yu.P.; Tonchev, A.; Vinogradov, V.G. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. ALUMINIUM 27 TARGET/alpha reactions; CROSS SECTIONS; ENERGY DEPENDENCE; FOILS; PROTONS

34337 (INIS-RU–347, pp. 292) **Alpha-particle scattering by ^{50}Ti at 40 and 50 MeV energies.** Kuterbekov, K.A.; Mukanov, A.K.; Pavlova, N.N.; Yushkov, A.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. TITANIUM 50/excited states; TITANIUM 50 TARGET/alpha reactions; DISTORTED WAVE THEORY

34338 (INIS-RU–347, pp. 293) **Data analysis on ^{3}He elastic and inelastic scattering at low and mean energies on nuclei with 40<A<124.** Bespalova, O.V. (Moskovskij Gosudarstvennyj

Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Romanovskij, E.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 4 refs. INTERMEDIATE MASS NUCLEI/helium 3 reactions; DISPERSION RELATIONS; ELASTIC SCATTERING; INELASTIC SCATTERING; MEV RANGE 10-100; MEV RANGE 100-1000

34339 (INIS-RU–347, pp. 294) **Study on nuclear multifragmentation by means of 4π-phase facility.** Avdeev, S.P. (and others); Karnaukhov, V.A.; Karch, V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. GOLD 196 TARGET/alpha reactions; GOLD 196 TARGET/nuclear fragmentation; GEV RANGE 01-10; NUCLEAR FRAGMENTS

34340 (INIS-RU–347, pp. 295) **Calculation of isomer ratios in the ^{130}Te(αn)^{133}Xe, ^{136}Ce(αn)^{139}Nd, ^{175}Lu(αn)^{178}Ta and ^{194}Pt(αn)^{197}Hg reactions.** Tulinov, A.F. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Fotina, O.V.; Chuvil'skaya, T.V.; Shavtvalov, D.Ya.; Shirokova, A.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 4 refs. ALPHA REACTIONS/isomer ratio; CERIUM 136 TARGET; LUTETIUM 175 TARGET; PLATINUM 194 TARGET; TELLURIUM 130 TARGET

34341 (INIS-RU–347, pp. 301) **Study on the two-nucleon transfer reactions by means of the ^{6}He secondary beams.** Aleksandrov, D.V.; Glukhov, Yu.A.; Nikol'skij, E.Yu.; Novatskij, B.G.; Stepanov, D.N. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. HELIUM 6 REACTIONS/two-nucleon transfer reactions; CARBON 12 TARGET; CARBON 14; DIFFERENTIAL CROSS SECTIONS; ENERGY LEVELS; HELIUM 6; HYDROGEN 1 TARGET; SECONDARY BEAMS

34342 (INIS-RU–347, pp. 302) **Search for excited states of ^{6}He rotating to the soft mode of dipole resonance.** Glukhov, Yu.A. (and others); Ogloblin, A.A.; Osadchij, O.Ya. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. HELIUM 6/excited states; LITHIUM 7 REACTIONS/charge-exchange reactions; MEV RANGE 10-100

34343 (INIS-RU–347, pp. 303) **Study on the ^{11}Li nuclear structure in the ^{11}B+^{14}C reaction.** Belozerov, A.V.; Vintsour, I.; Kalpakchieva, R.; Penionzhkevich, Yu.Eh.; Piskork, Yu. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. CARBON 14 TARGET/boron 11 reactions; LITHIUM 11/energy levels; COLLECTIVE EXCITATIONS

34344 (INIS-RU–347, pp. 304) **Mechanisms of nuclear reactions induced by ^{14}N ions on light nuclei.** Goryunov, O.Yu. (and others); Mokhnach, A.V.; Shvedov, A.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. NITROGEN 14 REACTIONS/nuclear reaction kinetics; COMPOUND-NUCLEUS REACTIONS; CROSS SECTIONS; MEV RANGE 100-1000

34345 (INIS-RU–347, pp. 305) **Mechanisms of the ^{12}C+^{14}NI reactions of E(^{14}E)≈13- MeV.** Gorbunov, O.Yu. (and others); Ziman, V.A.; Mokhnach, A.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. CARBON 12 TARGET/nitrogen 14 reactions; NITROGEN 14 REACTIONS/nuclear reaction kinetics

34346 (INIS-RU–347, pp. 306) **102-element isotope production in the ^{32}Ne+^{236}U and ^{26}Mg+^{232}Th reactions.** Andreev, A.N. (and others); Bogdanov, D.D.; Eremin, A.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 8 refs. THORIUM 232 TARGET/magnesium 26 reactions; URANIUM 236 TARGET/neon 22 reactions; NOBELIUM 253

34347 (INIS-RU–347, pp. 307) **Study on the nuclear fission in the region of the Busonaro-Gallone point.** Salamatin, V.S. (and others); Kozulin, Eh.M.; Tonchev, A.P. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. CARBON 12 REACTIONS/fission; MAGNESIUM 25 REACTIONS/fission; NEON 20 REACTIONS/fission; FISSION; LIQUID DROP MODEL

34348 (INIS-RU–347, pp. 308) **Effect of angular momentum on mass and energy distributions of fission fragments.** Chubaryan, G.G. (and others); Luk'yanyuk, S.M.; Penionzhkevich, Yu.Eh. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 4 refs. ELEMENT 104/fission; POLONIUM/fission; FISSION; LIMITING VALUES; POLONIUM

34349 (INIS-RU–347, pp. 310) **On a possibility of a direct experimental observation of the delayed fission effect of excited heavy nuclei by means of the shadow method.** Platonov, S.Yu. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Fotina, O.V.; Yuminov, O.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. FRANCIUM 213/fission; GOLD 197 TARGET/oxygen 16 reactions; COMPOUND NUCLEI; FISSION

34350 (INIS-RU–347, pp. 312) **^{11}Li(29 MeV/nucleon) elastic scattering on silicon nuclei.** Ann, R. (and others); Gijmo-Myuller, D.; Kordyash, A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. SILICON 28 TARGET/lithium 11 reactions; LITHIUM 11; WOODS-SAXON POTENTIAL

34351 (INIS-RU–347, pp. 313) **Correlation method for study on nonbound states of nuclei in multi-particle heavy ion reactions.** Pavlenko, Yu.N. (and others); Pugach, V.M.; Kolomiets, I.N. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. NICKEL 64 TARGET/nitrogen 14 reactions; TIN 124 TARGET/nitrogen 14 reactions; ENERGY LEVELS

34352 (INIS-RU–347, pp. 315) **Rainbow scattering of radioactive nuclei.** Ogloblin, A.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. HEAVY ION REACTIONS/elastic scattering; HEAVY ION REACTIONS/inelastic scattering; ISOBARIC ANALOGS

34353 (INIS-RU–347, pp. 317) **^{178m2}Hf exotic nucleus-target and heavy ion reactions.** Oganesyan, Yu.P. (and others); Brianson, V.; Vollerskhajm, Kh. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. ERBIUM 170 TARGET/carbon 12 reactions; HAFNIUM 178/nuclear reaction yield; YTTERBIUM 176 TARGET/alpha reactions

34354 (INIS-RU–347, pp. 318) **Shell effects and production cross sections of the Fr, Ra, and Ac neutron-deficient isotopes with N=126 in the ^{197}Au+^{20},^{22}Ne reactions.** Andreev, A.N. (and others); Bogdanov, D.D.; Vremin, A.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 7 refs. ACTINIUM ISOTOPES/fission; FRANCIUM ISOTOPES/fission; GOLD 197 TARGET/neon 20 reactions; GOLD 197 TARGET/neon 22 reactions; RADIUM ISOTOPES/fission; FISSION

34355 (INIS-RU–347, pp. 319) **Diffractive structure of pion spectrum in ion-ion collisions.** Chernyshev, D.A. (Voronezhskij Gosudarstvennyj Univ., Voronezh (Russian Federation)); Kopytin, I.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. NICKEL 58 TARGET/nitrogen 14 reactions; PIONS/particle production; URANIUM 238 TARGET/carbon 12 reactions; DIFFERENTIAL CROSS SECTIONS; DIFFRACTION MODELS; MEV RANGE 100-1000; PIONS; THRESHOLD ENERGY

34356 (INIS-RU–347, pp. 320) **Emission of fast positrons and electrons in ion-ion collisions at intermediate energies.** Batkin, I.S. (Voronezhskij Gosudarstvennyj Univ., Voronezh (Russian Federation)); Kopytin, I.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. ELECTRONS/particle production; HEAVY ION REACTIONS; POSITRONS/particle production; CARBON 12 REACTIONS; DIFFERENTIAL CROSS SECTIONS; ELECTRONS; MEV RANGE 100-1000; NICKEL 58 TARGET; NITROGEN 14 REACTIONS; NUCLEAR POTENTIAL; OPTICAL MODELS; POSITRONS; URANIUM 238 TARGET

34357 (INIS-RU–347, pp. 321) **Elastic scattering of antiprotons on ^{4}He nucleus.** Zhusupov, M.A.; Ibraeva, E.T.; Peresypkin, V.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. ANTIPROTON REACTIONS/elastic scattering; HELIUM 4 TARGET/antiproton reactions; DIFFERENTIAL CROSS SECTIONS; GLAUBER THEORY; MEV RANGE 10-100; MEV RANGE 100-1000

34358 (INIS-RU–347, pp. 323) **Shell structure of ^{12}C nucleus and slow π^--meson absorption.** Ivankov, Yu.V. (Voronezhskij Gosudarstvennyj Univ., Voronezh (Russian Federation)); Kadmenskij, S.G. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. CARBON 12 TARGET/pion minus reactions; PION MINUS REACTIONS/absorption; BORON 10; ENERGY SPECTRA; NEUTRONS; NUCLEAR REACTION YIELD; PAIR PRODUCTION; ABSORPTION

34359 (INIS-RU–347, pp. 325) **Proton polarization in the $^{12}C(K^+, K_p^+)^{11}B$ reaction at 0.6 and 0.85 GeV/c initial kaons.** Berdnikov, Ya.A.; Shishlo, A.P. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. CARBON 12 TARGET/kaon plus reactions; KAON PLUS REACTIONS/polarized products; BORON 11; KAONS PLUS; MEV RANGE 100-1000; PROTONS; RESCATTERING; SCATTERING AMPLITUDES; SPIN ORIENTATION

34360 (INIS-RU–347, pp. 326) **Proton polarization in the $d(K^+, K^+p)n$ reaction at 0.6 GeV/c kaon momentum.** Berdnikov, Ya.A.; Shishlo, A.P. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. DEUTERIUM TARGET/kaon plus reactions; AMPLITUDES; FINAL-STATE INTERACTIONS; KAONS PLUS; MEV RANGE 100-1000; NEUTRONS; POLARIZED PRODUCTS; PROTONS; SPIN ORIENTATION

34361 (INIS-RU–347, pp. 327) **Exhibition of (d^*+p) configuration of ^3He in elastic p^3He backscattering at 0.5-1.7 GeV.** Lado, A.V. (Kazakhskij Gosudarstvennyj Univ., Alma-Ata (Kazakhstan)); Uznikov, Yu.N. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 4 refs. HELIUM 3 TARGET/proton reactions; PROTON REACTIONS/nuclear reaction kinetics; BACKSCATTERING; CLUSTER MODEL; ELASTIC SCATTERING; GEV RANGE 01-10; HELIUM 3; MEV RANGE 100-1000; WAVE FUNCTIONS

34362 (INIS-RU–347, pp. 328) **Exhibition of nodal structure of ^6LI nucleus cluster wave function in αd photodisintegration channel.** Burkova, N.A. (Kazakhskij Gosudarstvennyj Univ., Alma-Ata (Kazakhstan)); Zhaksybekova, K.A.; Zhusupov, M.A.; Ehramzhyan, R.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref., 2 figs. LITHIUM 6 TARGET/photonuclear reactions; PHOTONUCLEAR REACTIONS/breakup reactions; ALPHA PARTICLES; CLUSTER MODEL; DEUTERONS; E2-TRANSITIONS; TOTAL CROSS SECTIONS; WAVE FUNCTIONS

34363 (INIS-RU–347, pp. 329) **Method of dispersion integration on masses of complex particles in application to deuteron breakup.** Anisovich, A.V. (AN SSSR, Leningrad (Russian Federation). Inst. Yadernoj Fiziki); Sadovnikova, V.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs., 1 fig. DEUTERIUM TARGET/photonuclear reactions; PHOTONUCLEAR REACTIONS/breakup reactions; AMPLITUDES; IMPULSE APPROXIMATION; NUCLEAR MODELS; TOTAL CROSS SECTIONS

34364 (INIS-RU–347, pp. 330) **Influence of final-state interaction on cross section of deuteron photodisintegration.** Anisovich, A.V. (AN SSSR, Leningrad (Russian Federation). Inst. Yadernoj Fiziki); Sadovnikov, V.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs., 1 fig. DEUTERIUM TARGET/photonuclear reactions; PHOTONUCLEAR REACTIONS/breakup reactions; FINAL-STATE INTERACTIONS; NUCLEON-NUCLEON INTERACTIONS; TOTAL CROSS SECTIONS

34365 (INIS-RU–347, pp. 331) **T-matrix approximation for description of (d, dp) and $(\alpha, \alpha p)$ reactions on light nuclei at mean energies.** Golovin, A.V.; Loshchakov, I.I. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. ALPHA REACTIONS/s matrix; DEUTERON REACTIONS/s matrix; LIGHT NUCLEI/alpha reactions; LIGHT NUCLEI/deuteron reactions; DEUTERIUM TARGET; HELIUM 3 TARGET; HELIUM 4 TARGET; LITHIUM 6 TARGET; MATRIX ELEMENTS

34366 (INIS-RU–347, pp. 332) **Competition of the nucleon quasi-free knockout by mean-energy antinucleons and antinucleon annihilation in nuclei.** Zavarzina, V.P.; Stepanov, A.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. ANTIPROTON REACTIONS/annihilation; ANTIPROTON REACTIONS/knock-out reactions; ANNIHILATION; CROSS SECTIONS; HEAVY NUCLEI; INTERMEDIATE MASS NUCLEI; LIGHT NUCLEI; MEV RANGE 10-100; NUCLEONS; QUASI-FREE REACTIONS

34367 (INIS-RU–347, pp. 333) **On the polarized electron scattering by oriented nuclei.** Tartakovskij, V.K. (Kievskij Gosudarstvennyj Univ., Kiev (Ukraine)); Lyong Zuen Fu; Fursaev, A.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. ORIENTED NUCLEI/electron reactions; DIFFERENTIAL CROSS SECTIONS; ELECTRONS; POLARIZED BEAMS; POLARIZED PRODUCTS

34368 (INIS-RU–347, pp. 334) **Sensitivity analysis of reaction cross section and zero-angle scattering amplitude to structure of nuclear optical potential for 1.37 GeV alpha particles.** Zavarzina, V.P.; Stepanov, A.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. ALPHA REACTIONS/nuclear potential; POTASSIUM ISOTOPES/alpha reactions; ELASTIC SCATTERING; OPTICAL MODELS; SCATTERING AMPLITUDES; SENSITIVITY ANALYSIS; TOTAL CROSS SECTIONS

34369 (INIS-RU–347, pp. 335) **Common potential of hadron-nuclear interaction at particle energies $\leq$1 GeV in kinematically corrected impulse approximation.** Makhov, A.M. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. HADRON REACTIONS/impulse approximation; HADRON REACTIONS/nuclear potential; MEV RANGE 100-1000; OPTICAL MODELS; SCATTERING AMPLITUDES

34370 (INIS-RU–347, pp. 337) **Two-particle photodisintegration of three-nucleon nuclei and polarization phenomena at low energies.** Kozlovskij, I.V. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Teoreticheskoj Fiziki); Gurin, Yu.L.; Malyarzh, E.M.; Tartakovskij, V.K. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. HELIUM 3 TARGET/photonuclear reactions; PHOTONUCLEAR REACTIONS/breakup reactions; TRITIUM TARGET/photonuclear reactions; DEUTERONS; MEV RANGE 10-100; NEUTRONS; POLARIZED BEAMS; POLARIZED PRODUCTS; PROTONS

34371 (INIS-RU–347, pp. 338) **Elastic scattering of antiprotons by ^{12}C and ^{16}O nuclei and α-cluster model with dispersion.** Berezhnoj, Yu.A. (Khar'kovskij Gosudarstvennyj Univ., Kharkov (Ukraine)); Mikhajlyuk, V.P.; Pilipenko, V.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. ANTIPROTON REACTIONS/cluster model; CARBON 12 TARGET/antiproton reactions; OXYGEN 16 TARGET/antiproton reactions; DIFFERENTIAL CROSS SECTIONS; ELASTIC SCATTERING; MEV RANGE 100-1000; SPIN ORIENTATION

34372 (INIS-RU–347, pp. 339) **Comparative description pA and p-barA scattering under diffraction scaling conditions.** Berezhnoj, Yu.A. (Khar'kovskij Gosudarstvennyj Univ., Kharkov (Ukraine)); Kudryavtsev, I.N.; Soznik, A.P. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. ANTIPROTON REACTIONS/diffraction models; CARBON 12 TARGET/antiproton reactions; CARBON 12 TARGET/proton reactions; DIFFERENTIAL CROSS SECTIONS; S MATRIX; SCALING LAWS

34373 (INIS-RU–347, pp. 340) **Elastic scattering and breakup of weakly coupled particles in adiabatic approximation.** Verbitskij, V.P. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yademykh Issledovanij); Terenetskij, K.O. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. HEAVY ION REACTIONS/adiabatic approximation; HEAVY ION REACTIONS/light ions; BREAKUP REACTIONS; COULOMB FIELD; DIFFERENTIAL CROSS SECTIONS; NEUTRON-RICH ISOTOPES; NUCLEI; TOTAL CROSS SECTIONS

34374 (INIS-RU–347, pp. 342) **On the D+D fusion reaction.** Sokolov, M.V. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij). AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. DEUTERIUM TARGET/deuteron reactions; FINAL-STATE INTERACTIONS; FUSION YIELD; NUCLEAR REACTION KINETICS; PROTONS; THRESHOLD ENERGY; TRITIUM

34375 (INIS-RU–347, pp. 344) **Photodisintegration of ^{16}O nucleus in J matrix method.** Knyr, V.A. (Khabarovskij Politekhnicheskij Inst., Khabarovsk (Russian Federation)); Mazur, A.I.; Smirnov, Yu.F.; Shirokov, A.M. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs., 1 fig. OXYGEN 16 TARGET/photonuclear reactions; PHOTONUCLEAR REACTIONS/breakup reactions; CROSS SECTIONS; ENERGY LEVELS; MATRICES; NUCLEAR POTENTIAL; SHELL MODELS

34376 (INIS-RU–347, pp. 347) **Taking corrections for inelastic scattering of deuterons and α-particles on light nuclei at mean energies.** Il'in, I.M. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki). AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.
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Short communication. 3 refs. CARBON 12 TARGET/alpha reactions; CARBON 12 TARGET/deuteron reactions; OXYGEN 16 TARGET/alpha reactions; OXYGEN 16 TARGET/deuteron reactions; CORRECTIONS; SHELL MODELS; TOTAL CROSS SECTIONS; WOODS-SAXON POTENTIAL

34377 (INIS-RU–347, pp. 352) **Potential description of light nucleus electrodisintegration.** Zhusupov, M.A.; Ibraeva, E.T.; Usmanov, T.G. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.
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Short communication. 3 refs. BERYLLIUM 9 TARGET/electron reactions; ELECTRON REACTIONS/knock-out reactions; LITHIUM 6 TARGET/electron reactions; ALPHA PARTICLES; CLUSTER MODEL; DEUTERONS; ENERGY SPECTRA; NUCLEONS; POTENTIALS

34378 (INIS-RU–347, pp. 353) **P-odd effects in neutron interactions with ^{117}Sn and ^{139}La nuclei and negative resonance positions.** Barabanov, A.L. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.
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Short communication. 3 refs. LANTHANUM 139 TARGET/neutron reactions; TIN 117 TARGET/neutron reactions; P STATES; PARITY; POLARIZED BEAMS; SLOW NEUTRONS; TRANSMISSION

34379 (INIS-RU–347, pp. 354) **Dependence of nucleon-nucleus interaction cross section on momentum distribution of nucleons in the nucleus-target.** Galanina, L.I. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Zelenskaya, N.S. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.
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Short communication. 4 refs. CARBON 12 TARGET/proton reactions; OXYGEN 16 TARGET/proton reactions; PROTON REACTIONS/differential cross sections; DISTRIBUTION FUNCTIONS; GEV RANGE 01-10; NUCLEONS; WAVE FUNCTIONS

34380 (INIS-RU–347, pp. 355) **Spin-isospin response of nucleus in process of the single charge-exchange pion.** Kurepin, A.B.; Topil'skaya, N.S.; Kulagin, S.A.; Al'beriko, V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.
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Short communication. 2 refs. PION REACTIONS/charge-exchange reactions; ISOSPIN; MEV RANGE 100-1000; NUCLEAR MATTER; PIONS; RANDOM PHASE APPROXIMATION; RESPONSE FUNCTIONS; SPIN

34381 (INIS-RU–347, pp. 356) **Estimation of the (n,n') reaction cross sections on ^{208}Pb nucleus.** Barabanov, A.L.; Kloss, Yu.Yu. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.
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Short communication. 3 refs. LEAD 208 TARGET/neutron reactions; CROSS SECTIONS; ENERGY DEPENDENCE; EXCITED STATES; INELASTIC SCATTERING; MEV RANGE 01-10; NEUTRONS; NUCLEAR POTENTIAL; OPTICAL MODELS

34382 (INIS-RU–347, pp. 357) **Optical method for calculation of the compound process cross sections.** Ezhov, S.N. (Kievskij Gosudarstvennyj Univ., Kiev (Ukraine)); Plyujko, V.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.
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Short communication. 2 refs. NEUTRON REACTIONS/compound-nucleus reactions; TUNGSTEN 182 TARGET/neutron reactions; TUNGSTEN 184 TARGET/neutron reactions; TUNGSTEN 186 TARGET/neutron reactions; CROSS SECTIONS; ELASTIC SCATTERING; EXCITATION FUNCTIONS; MEV RANGE 01-10; ROTATIONAL STATES

34383 (INIS-RU–347, pp. 358) **Optical potential and t matrix of neutron-nucleus scattering in Hartree-Fock approximation.** Kuprikov, V.I. (AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst.); Soznik, A.P. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.
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Short communication. 3 refs. NEUTRON REACTIONS/nuclear potential; NEUTRON REACTIONS/s matrix; POTASSIUM 40 TARGET/neutron reactions; ELASTIC SCATTERING; HARTREE-FOCK METHOD; MEV RANGE 01-10; MEV RANGE 10-100; OPTICAL MODELS; PHASE SHIFT; SKYRME POTENTIAL

34384 (INIS-RU–347, pp. 359) **Using the real nuclear Hamiltonian for analysis of nucleon scattering by nonaxial deformed even-even nuclei.** Porodzinskij, Yu.V.; Sukhovitskij, E.Sh. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.
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Short communication. NEUTRON REACTIONS/coupled channel theory; COLLECTIVE MODEL; DEFORMED NUCLEI; EVEN-EVEN NUCLEI; HAMILTONIANS; ROTATIONAL STATES; S MATRIX; SCATTERING; SELENIUM 76 TARGET; URANIUM 238 TARGET

34385 (INIS-RU–347, pp. 360) **Microscopic description of the proton-light nuclei diffraction interaction.** Ismatov, E.I. (AN Uzbekskoj SSR, Tashkent (Uzbekistan). Inst. Yadernoj Fiziki). AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. CARBON 12 TARGET/proton reactions; PROTON REACTIONS/glauber theory; PROTON REACTIONS/knock-out reactions; DIFFERENTIAL CROSS SECTIONS; INELASTIC SCATTERING; L-S COUPLING; MATRIX ELEMENTS; PROTONS; SHELL MODELS

34386 (INIS-RU–347, pp. 361) **Excitation of low-lying states in oriented nuclei with nonzero spin by polarized protons.** Kudryavtsev, I.N. (Khar'kovskij Gosudarstvennyj Univ., Kharkov (Ukraine)); Soznik, A.P. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs., 1 fig. CARBON 13 TARGET/proton reactions; CROSS SECTIONS; EXCITATION; EXCITED STATES; INELASTIC SCATTERING; MEV RANGE 100-1000; ORIENTED NUCLEI; POLARIZED BEAMS; SHELL MODELS; SPIN

34387 (INIS-RU–347, pp. 362) **Theoretical investigation of gamma radiation of excited nuclei in the $\gamma A \rightarrow \pi A^*$ reactions.** Tryasuchev, V.A.; Kolchin, A.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. CARBON 12 TARGET/photonuclear reactions; PHOTONUCLEAR REACTIONS/shell models; ANGULAR DISTRIBUTION; BORON 12; CARBON 12; DIFFERENTIAL CROSS SECTIONS; EXCITED STATES; GAMMA RADIATION; INTERMEDIATE COUPLING; PIONS; POLARIZED PRODUCTS

34388 (INIS-RU–347, pp. 364) **Multi-phonon version of the coupled channel method and cross section analysis of low-energy neutron inelastic scattering by spherical nuclei.** Samojlov, V.V. (Moskovskij Inzhenerno-Fizicheskij Inst., Moscow (Russian Federation)); Urin, M.G. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 4 refs. NEUTRON REACTIONS/coupled channel theory; NEUTRON REACTIONS/inelastic scattering; NUCLEI/neutron reactions; NUCLEI; PHONONS; SPHERICAL MODEL; TOTAL CROSS SECTIONS; WAVE FUNCTIONS

34389 (INIS-RU–347, pp. 368) **Connection of macroscopic and microscopic approaches to the description of the double nuclear system dynamics.** Adamyan, G.G. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Antonenko, N.V.; Dzholos, R.V.; Nasirov, A.K. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. ARGON 40 REACTIONS/heavy ion fusion reactions; ARGON 40 REACTIONS/quasi-fission; SULFUR 32 REACTIONS/heavy ion fusion reactions; SULFUR 32 REACTIONS/quasi-fission; THORIUM 232 TARGET/argon 40 reactions; URANIUM 238 TARGET/sulfur 32 reactions; QUASI-FISSION; MASS SPECTRA; MULTI-NUCLEON TRANSFER REACTIONS; NUCLEAR FRAGMENTS; NUCLEAR POTENTIAL; NUCLEAR REACTION KINETICS; NUCLEAR TEMPERATURE

34390 (INIS-RU–347, pp. 369) **Role of quantum fluctuations in decay of double nuclear system.** Antonenko, N.V. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Dzholos, R.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. HEAVY ION REACTIONS/compound nuclei; HEAVY ION REACTIONS/fluctuations; ALPHA PARTICLES; ARGON IONS; CHROMIUM IONS; EQUATIONS OF MOTION; FLUCTUATIONS; NUCLEAR DECAY

34391 (INIS-RU–347, pp. 370) **Shaking-off nucleons with weakly coupled projectile and their rescattering in the nucleus-target field.** Zagrebaev, V.I. (Chuvashskij Gosudarstvennyj Univ., Cheboksary (Russian Federation)). AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. LITHIUM 11 REACTIONS/stripping; CROSS SECTIONS; STRIPPING; LITHIUM 9; NEUTRON-RICH ISOTOPES; NEUTRONS; RESCATTERING; TARGETS

34392 (INIS-RU–347, pp. 373) **Analysis of the angular correlation function in the massive transfer reactions in the frame of direct and statistical approaches.** Belyaeva, T.L. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Zelenskaya, N.S.; Odintsov, N.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. CARBON 12 TARGET/nitrogen 14 reactions; NITROGEN 14 REACTIONS/angular correlation; NITROGEN 14 REACTIONS/incomplete fusion reactions; ALPHA PARTICLES; COMPOUND-NUCLEUS REACTIONS; DEUTERONS; DIFFERENTIAL CROSS SECTIONS; EXCITED STATES; MAGNESIUM 24; MEV RANGE 10-100; STATISTICAL MODELS

34393 (INIS-RU–347, pp. 374) **Study on the A(^{11}LI, ^{9}LI) reaction mechanisms and ^{11}LI nucleus structure.** Vasil'ev, Yu.O. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij);

Evlanov, M.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs., 1 tab. CARBON 12 TARGET/lithium 11 reactions; COPPER 63 TARGET/lithium 11 reactions; LEAD 208 TARGET/lithium 11 reactions; LITHIUM 11 REACTIONS/integral cross sections; GEV RANGE 01-10; LITHIUM 11; LITHIUM 9; NUCLEAR FRAGMENTATION; THEORETICAL DATA; WAVE FUNCTIONS

34394 (INIS-RU–347, pp. 375) **Particle emission in quasi-fission reactions.** Aleshin, V.P. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij). AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. ALPHA PARTICLES/multiplicity; INTERMEDIATE MASS NUCLEI/quasi-fission; NEUTRONS/multiplicity; PROTONS/multiplicity; QUASI-FISSION; MULTIPLICITY; ANGULAR DISTRIBUTION; FISSION FRAGMENTS; QUASI-FISSION; NEUTRONS; PROTONS

34395 (INIS-RU–347, pp. 376) **Mixed representation for the heavy ion transfer process amplitudes.** Bunakov, V.E.; Valiev, F.F.; Zagrebaev, V.I. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. INCOMPLETE FUSION REACTIONS/transition amplitudes; IMPACT PARAMETER; PARTIAL WAVES; SINGULARITY; THREE-DIMENSIONAL CALCULATIONS; WAVE FUNCTIONS

34396 (INIS-RU–347, pp. 377) **Subbarrier fusion of identical heavy nuclei.** Denisov, V.Yu. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij). AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. NICKEL 58 REACTIONS/heavy ion fusion reactions; NICKEL 58 TARGET/nickel 58 reactions; NICKEL 64 REACTIONS/heavy ion fusion reactions; NICKEL 64 TARGET/nickel 64 reactions; CROSS SECTIONS; NUCLEAR DEFORMATION; NUCLEAR POTENTIAL

34397 (INIS-RU–347, pp. 378) **Shell structure influence on distribution of excitation energy between nuclei.** Adamyan, G.G. (AN Uzbekskoj SSR, Tashkent (Uzbekistan). Inst. Yadernoj Fiziki); Muminov, A.I.; Nasirov, A.K.; Permyakov, V.P. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 5 refs. CHROMIUM 54 REACTIONS/multinucleon transfer reactions; LEAD 208 TARGET/chromium 54 reactions; EXCITED STATES; MEV RANGE 100-1000; NUCLEAR FRAGMENTS; OCCUPATION NUMBER; SINGLE-PARTICLE MODEL

34398 (INIS-RU–347, pp. 379) **Theoretical interpretation of semiempirical formula for total cross sections of nucleus-nucleus reactions.** Sergeev, V.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. HEAVY ION REACTIONS/glauber theory; HEAVY ION REACTIONS/total cross sections; ENERGY DEPENDENCE; GEV RANGE; ION BEAMS; MASS NUMBER; OPTICAL MODELS; TARGETS

34399 (INIS-RU–347, pp. 380) **Stochastic model of heated fissile nucleus relation.** Rubchenya, V.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. FISSION/stochastic processes; FISSION; FISSION NEUTRONS; NUCLEAR TEMPERATURE; NUCLEI; RELAXATION; ROTATIONAL STATES

34400 (INIS-RU–347, pp. 381) **Study on the reaction product spectra at high excitation energies of nuclei.** Vasil'ev, Yu.O. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Evlanov, M.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs., 1 fig. LEAD 208 TARGET/neon 20 reactions; NEON 20 REACTIONS/diffraction models; ENERGY SPECTRA; EXPERIMENTAL DATA; LEAD 209; MEV RANGE 100-1000; NEON 19; NUCLEAR FRAGMENTS

34401 (INIS-RU–347, pp. 382) **Angular momentum of compound nuclei in the heavy ion near-barrier fusion reactions.** Tarakanov, A.V. (Saratovskij Gosudarstvennyj Univ., Saratov (Russian Federation)); Shilov, V.M. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. CERIUM 132/angular momentum; CERIUM 132/compound nuclei; HEAVY ION FUSION REACTIONS; GAMMA DECAY; MOLYBDENUM 100 TARGET; MOLYBDENUM 96 TARGET; SULFUR 32 REACTIONS; SULFUR 36 REACTIONS

34402 (INIS-RU–347, pp. 436) **Precise method for operative measurement of material absorption properties for γ- and β-radiations.** Krasheninnikov, V.D. (Kievskij Gosudarstvennyj Univ., Kiev (Ukraine)); Morgunov, Eh.I. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International

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Short communication. 1 ref. ALUMINIUM ALLOYS/transmission; GLASS/transmission; STEELS/transmission; ABSORPTION; TRANSMISSION; BETA PARTICLES; GAMMA RADIATION; GLASS; KEV RANGE 10-100; RADIATION DOSES; STEELS; THICKNESS; TIME DEPENDENCE

34403 (INIS-RU–347, pp. 445) **Role of multiple exchange of nucleon in the $^{16}O(d,p)^{17}O^*$ stripping in the polarization characteristics calculation.** Gurbanovich, I.S. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Neudachin, V.G.; Romanovskij, E.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. OXYGEN 16 TARGET/deuteron reactions; OXYGEN 16 TARGET/stripping; COUPLED CHANNEL THEORY; DIFFERENTIAL CROSS SECTIONS; EXCITED STATES; MULTIPLE SCATTERING; STRIPPING; OXYGEN 17; PROTONS; SPIN ORIENTATION

34404 (INIS-RU–347, pp. 448) **Cross sections of radioisotopes production in the silver target irradiated by protons with 660 MeV energy.** Aleksandrov, Yu.V. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Astapov, A.A.; Vasil'ev, S.K. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. SILVER/isotope production; SILVER/proton reactions; CROSS SECTIONS; FLUX DENSITY; HALF-LIFE; MEV RANGE 100-1000; RADIOISOTOPES; SILVER; TARGETS

34405 (INIS-RU–347, pp. 450) **Measurement of the triton production cross sections in interaction of deuterons with ^{9}Be.** Abramovich, S.N.; Vinogradov, Yu.I.; Generalov, L.N.; Guzhovskij, B.Ya.; Kamskaya, E.V.; Kryazhimskaya, L.N.; Orlikova, E.G.; Popov, V.N.; Sabanin, B.N. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. BERYLLIUM 9 TARGET/deuteron reactions; TRITONS/particle production; BETA DETECTION; ERRORS; LITHIUM 9; MEV RANGE 01-10; TOTAL CROSS SECTIONS; TRITONS

34406 (INIS-RU–347, pp. 453) **Threshold effects in compound reactions followed by fission.** Serov, V.I. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. COMPOUND-NUCLEUS REACTIONS/fission; FISSION; EVEN-EVEN NUCLEI; EVEN-ODD NUCLEI; EXCITED STATES; FISSION BARRIER; HEAVY NUCLEI; THRESHOLD ENERGY

34407 (INIS-RU–347, pp. 454) **Measurement of partial cross sections of the $^{9}Be(d,p)^{10}Be$ reactions.** Abramovich, S.N.; Vinogradov, Yu.I.; Generalov, L.N.; Guzhovskij, B.Ya.; Protopopov, V.N.; Sabanin, B.P.; Solodovnikov, A.P.; Chulkov, V.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. BERYLLIUM 9 TARGET/deuteron reactions; BERYLLIUM 10; DIFFERENTIAL CROSS SECTIONS; ERRORS; EXCITED STATES; MEV RANGE 01-10; PROTON DETECTION; PROTONS; SEMICONDUCTOR DETECTORS

34408 (INIS-RU–347, pp. 456) **Proton reactions rates on nuclei ^{6}Li, ^{7}Li and ^{9}Be.** Abramovich, S.N.; Guzhovskij, B.Ya.; Dunaeva, S.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. BERYLLIUM 9 TARGET/proton reactions; LITHIUM 6 TARGET/proton reactions; LITHIUM 7 TARGET/proton reactions; ALPHA PARTICLES; BERYLLIUM 10; DEUTERIUM; GAMMA RADIATION; HELIUM 3; HELIUM 4; LITHIUM 6; LITHIUM 7; LITHIUM 8; NUCLEAR REACTION KINETICS

34409 (INIS-RU–347, pp. 457) **Excitation of long-living isomers in the (n,n')-reaction.** Alpatov, V.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (Russian Federation). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki); Bojko, S.I.; Davydov, A.V.; Rad'ko, V.E. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. RHODIUM 103/neutron reactions; SILVER 107/neutron reactions; SILVER 109/neutron reactions; ACTIVATION ENERGY; CROSS SECTIONS; EXCITATION; FLUX DENSITY; ISOMERIC NUCLEI; KEV RANGE 10-100; MEV RANGE 10-100; NEUTRON FLUX; RADIOACTIVITY

34410 (LBL–34277) **Production and polarization of beta-emitting projectile fragment ^{43}Ti.** Matsuta, K. (Osaka Univ., Toyonaka (Japan). Dept. of Physics); Ozawa, A.; Nojiri, Y. Lawrence Berkeley Lab., CA (United States). May 1993. 5p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract AC03-76SF00098. (CONF-930534–5: 3. international conference on radioactive nuclear beams, East Lansing, MI (United States), 24-27 May 1993). Order Number DE93018529. Source: OSTI; NTIS; INIS; GPO Dep.

The projectile fragmentation of ^{46}Ti on Au and C targets has been studied at 116A MeV. For one of the fragment nuclei, ^{43}Ti, production cross sections, longitudinal momentum distributions, angular distributions, and fragment polarization were observed. The observed angular distribution and the spin polarization of ^{43}Ti for the C target suggested negative angle deflection of the nuclei due to the nuclear attractive potential. The magnetic moment of ^{43}Ti

was determined by means of β-NMR technique as $|\mu| = (0.85 \pm 0.02)\ \mu_N$.

34411 (UCRL-JC–113180) **Calculation of nuclear data for incident energies to 200 MeV with the FKK-GNASH code system.** Chadwick, M.B. (Lawrence Livermore National Lab., CA (United States)); Young, P.G. Lawrence Livermore National Lab., CA (United States). Feb 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930168–7: Simulating accelerator radiation environments workshop, Santa Fe, NM (United States), 11-15 Jan 1993). Order Number DE93018089. Source: OSTI; NTIS; INIS; GPO Dep.

We describe how the FKK-GNASH code system has been extended to calculate nucleon-induced reactions up to 200 MeV, and used to predict (p,xn) and (p,xp) cross sections on ^{208}Pb at incident energies of 25, 45, 80 and 160 MeV, for an intermediate energy code intercomparison. Details of the reaction mechanisms calculated by FKK-GNASH are given, and the calculational procedure is described.

34412 (UCRL-JC–113668) **Radiative capture mechanisms in the ^{89}Y($\vec{p}$,γ) reaction.** Parker, W.E. (Lawrence Livermore National Lab., CA (United States)); Dietrich, F.S.; Sale, K.E.; Kammeraad, J.E.; Luke, S.J.; Weller, H.R.; Chasteler, R.M.; Godwin, M.A.; Kramer, L.; Schmid, G.J. Lawrence Livermore National Lab., CA (United States). 28 Jul 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48 ;FG05-91ER40619. (CONF-9309173–3: Capture gamma-ray symposium, Fribourg (Switzerland), 20-24 Sep 1993). Order Number DE93018629. Source: OSTI; NTIS; INIS; GPO Dep.

We have measured the spectra of gamma rays from approximately 14 MeV to the endpoint in the ^{89}Y($\vec{p}$,γ) reaction with 19.6 MeV polarized protons from the TUNL tandem accelerator. Gamma spectra were measured with a pair of 25.4 cm × 25.4 cm anticoincidence shielded NaI detectors at angles of 30, 55, 90, 125, and 150° with respect to the incident beam. The γ-ray spectra show significant analyzing powers and forward peaking of the angular distributions. These features allow for the discrimination between compound processes which do not exhibit interference between different channels, and direct processes. The observed interference effects indicate that multistep-direct processes are important at γ-ray energies lower than those for which direct-semidirect capture is the dominant mechanism.

6635 Nuclear Mass Ranges

Refer also to citation(s) 34065, 34066, 34068, 34070, 34071, 34072, 34073, 34075, 34077, 34078, 34080, 34081, 34082, 34083, 34084, 34085, 34086, 34087, 34088, 34089, 34090, 34095, 34096, 34097, 34100, 34101, 34104, 34106, 34109, 34125, 34135, 34141, 34142, 34144, 34145, 34148, 34150, 34154, 34156, 34157, 34158, 34159, 34160, 34161, 34162, 34163, 34164, 34166, 34167, 34168, 34169, 34170, 34171, 34172, 34173, 34174, 34175, 34176, 34177, 34178, 34179, 34180, 34182, 34183, 34184, 34185, 34186, 34187, 34188, 34190, 34194, 34195, 34196, 34198, 34199, 34200, 34201, 34203, 34204, 34205, 34206, 34208, 34209, 34210, 34211, 34212, 34213, 34214, 34215, 34216, 34218, 34229, 34230, 34237, 34246, 34247, 34248, 34249, 34250, 34251, 34253, 34254, 34258, 34259, 34260, 34262, 34263, 34264, 34265, 34266, 34268, 34269, 34270, 34271, 34272, 34274, 34275, 34276, 34277, 34280, 34281, 34285, 34286, 34287, 34291, 34292, 34295, 34296, 34297, 34298, 34299, 34300, 34301, 34302, 34303, 34304, 34305, 34306, 34307, 34308, 34309, 34310, 34311, 34312, 34313, 34314, 34315, 34316, 34318, 34321, 34323, 34325, 34326, 34327, 34328, 34329, 34330, 34331, 34333, 34334, 34335, 34336, 34339, 34345, 34346, 34349, 34350, 34351, 34353, 34357, 34358, 34359, 34360, 34361, 34362, 34363, 34364, 34365, 34370, 34371, 34372, 34375, 34376, 34378, 34379, 34381, 34382, 34383, 34385, 34386, 34387, 34389, 34405, 34407, 34408, 34410, 34411, 34412, 34415, 34431

6636 Radiation Physics

Refer also to citation(s) 32620, 32798, 33630, 34244, 34594

34413 (ANL/ER/CP–79720) **Basic physical and chemical information needed for development of Monte Carlo codes.** Inokuti, M. Argonne National Lab., IL (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9304185–1: DOE workshop on computational approaches in molecular radiation biology: Monte Carlo methods, Irvine, CA (United States), 26-29 Apr 1993). Order Number DE93018571. Source: OSTI; NTIS; INIS; GPO Dep.

It is important to view track structure analysis as an application of a branch of theoretical physics (i.e., statistical physics and physical kinetics in the language of the Landau school). Monte Carlo methods and transport equation methods represent two major approaches. In either approach, it is of paramount importance to use as input the cross section data that best represent the elementary microscopic processes. Transport analysis based on unrealistic input data must be viewed with caution, because results can be misleading. Work toward establishing the cross section data, which demands a wide scope of knowledge and expertise, is being carried out through extensive international collaborations. In track structure analysis for radiation biology, the need for cross sections for the interactions of electrons with DNA and neighboring protein molecules seems to be especially urgent. Finally, it is important to interpret results of Monte Carlo calculations fully and adequately. To this end, workers should document input data as thoroughly as possible and report their results in detail in many ways. Workers in analytic transport theory are then likely to contribute to the interpretation of the results.

34414 (CNIC–00530, pp. 42-47) **Progress on neutron data evaluation activities in Lanzhou University.** Yao Lishan (Institute of Nuclear Research, Lanzhou Univ. (China)). Chinese Nuclear Data Center, Beijing, BJ (China); China Nuclear Information Centre, Beijing, BJ (China). Jun 1991. (CNDC–0006;INDC(CPR)–022/L.). In *Communication of nuclear data progress: No.5 (1991).* 77p. Order Number DE93633161. Source: OSTI; NTIS (US Sales Only); INIS.

Lanzhou University is one of the earliest units which joined the Chinese Nuclear Data coordination Network. The evaluation of neutron nuclear data, the theoretical calculation for neutron data and the systematics of neutron reaction cross section in Lanzhou University is introduced. The evaluations of Ti, Sn, Sb, ^{181}Ta have been completed respectively. The systematic study for (n, 2n), (n, 3n) and (n, x) (x = p, t, ^{3}He, d, α) reaction cross sections have been performed. The evaluations and theoretical calculations of neutron resonance parameters, γ production data and the double differential neutron emitted cross sections are performed.

34415 (CNIC–00645) **Communication of nuclear data progress: No.7 (1992).** Chinese Nuclear Data Center, Beijing, BJ (China); China Nuclear Information Centre, Beijing, BJ (China). Jun 1992. 119p. (CNDC–0009;INDC(CPR)–027/L.). Order Number DE93633241. Source: OSTI; NTIS (US Sales Only); INIS.

This is the seventh issue of communication of Nuclear Data Progress (CNDP), in which the nuclear data progress in china during the last year is presented. It includes 14 MeV neutron activation cross section nuclear decay data inelastic angular distribution integral prompt spontaneous fission neutron spectrum and α spectrum measurements of reaction ^{40}Ca(n, α); programs UNF-for fast neutron data calculation of structural materials, APCOM and APOM for searching optimal charged particle and neutron optical potential parameters respectively; P + ^{63}Cu reaction calculation in energy region 3 ≈ 55 MeV; evaluation of ^{197}Au (n, Zn) ^{196}Au cross section, progress on nuclear structure and decay data evaluation for A-chain a database on ion-atom collision processes, and evaluation of trapping and desorption data, systematics calculation of nuclear data for radiation damage assessment and related safety aspects, and systematics of (n, t) and (n, ^{3}He) reaction cross sections at 14 MeV, construction of covariance matrix for experimental data, Spline fit for multi-sets of correlative data etc.

34416 (CTH-RF–94) **Exact solution of some one-speed neutron transport problems.** Sjoestrand, N.G. Chalmers Univ. of Technology, Goeteborg (Sweden). Dept. of Reactor Physics. Dec 1992. 18p. Order Number DE94600425. Source: OSTI; NTIS; INIS.

An analytical solution has earlier been obtained to the one-speed neutron transport equation for infinite slabs with reflection coefficient +1 or -1 on both sides. The solution is now extended to an

arbitrary number of terms in the scattering function. It is shown that some problems with strongly forward and backward scattering can also be solved exactly. Further, the corresponding problem for a sphere and with time dependence is discussed. (16 refs.).

34417 (DOE/FTR–93015636) **Travel to Italy to attend conference on small-angle x-ray and neutron scattering: Foreign trip report, May 9–20, 1993.** Schaefer, D.W. Sandia National Labs., Albuquerque, NM (United States). 8 Jun 1993. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93015636. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The NATO Advanced Study Institute on Advanced Topics in Small Angle Scattering was designed to expose young scientists from NATO countries to recent advances through lectures presented by leading experts from around the world. Although participants are primarily from NATO countries, NATO policy now encourages participation by scientists from former Soviet block countries. Dr. Schaefer presented a lecture on application of small-angle neutron scattering to the study of porous ceramic materials. In addition he offended lecture and workshops presented by other scientists. The highlight of the conference was a brief presentation by the aging Dr. Andre Guinier, the inventor of the small-angle scattering technique. Guinier described his experience 50 years ago when he first observed and explained x-ray scattering at very small angles.

34418 (INIS-RU–347, pp. 198) **Production and investigation on the beam of circularly polarized shower γ-quanta in crystal media.** Nadzhafov, I.M.; Radzhabov, M.R. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. PHOTON BEAMS/beam production; PHOTON BEAMS/crystals; AMORPHOUS STATE; BORN APPROXIMATION; BREMSSTRAHLUNG; CASCADE SHOWERS; CRYSTALS; POLARIZED BEAMS

34419 (INIS-RU–347, pp. 237) **Excitation cross-section of L-shell characteristic X-rays of neptunium by protons.** Glavanakov, I.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. NEPTUNIUM/proton beams; NEPTUNIUM/x radiation; CROSS SECTIONS; EXPERIMENTAL DATA; GOLD; NEPTUNIUM

34420 (INIS-RU–347, pp. 399) **Application of the nuclear backscattering method for measurement of the proton stopping cross sections in the 80-240 keV energy range.** Dzhassim, M.N. (Kievskij Gosudarstvennyj Univ., Kiev (Ukraine)); Krasheninnikov, V.D.; Shevchenko, V.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs., 1 tab. PROTON BEAMS/backscattering; PROTON BEAMS/energy spectra; CADMIUM; CROSS SECTIONS; ENERGY DEPENDENCE; ENERGY RESOLUTION; GOLD; IRON; KEV RANGE 100-1000; NANO AMP BEAM CURRENTS; BACKSCATTERING; SI SEMICONDUCTOR DETECTORS; SILICON; SURFACE BARRIER DETECTORS; TARGETS

34421 (KFKI–1992-28/B,G) **Killing symmetries in neutron transport.** Lukacs, B.; Racz, A. Hungarian Academy of Sciences, Budapest (Hungary). Central Research Inst. for Physics. Oct 1992. 20p. Order Number DE94600426. Source: OSTI; NTIS (US Sales Only); INIS.

Although inside the reactor zone there is no exact continuous spatial symmetry, in certain configurations neutron flux distribution is close to a symmetrical one. In such cases the symmetrical solution could provide a good starting point to determine the non-symmetrical power distribution. All possible symmetries are determined in the 3-dimensional Euclidean space, and the form of the transport equation is discussed in such a coordinate system which is adapted to the particular symmetry. Possible spontaneous symmetry breakings are pointed out. (author) 6 refs.

34422 (KFKI–1992-30/A) **To the problem of the coherence length of neutrons.** Varga, P. Hungarian Academy of Sciences, Budapest (Hungary). Central Research Inst. for Physics. Nov 1992. 16p. Order Number DE94600427. Source: OSTI; NTIS (US Sales Only); INIS.

The challenge of the high accuracy of certain optical measurements, the long coherence length of light provokes one to search for possibilities to enlarge the neutron coherence length. A proposal is made to achieve this by using a five or a four plate Bonse-Hart interferometer. A further problem is, whether the neutron beam is composed of wave packets or of overlapping independent monochromatic waves; it is considered that the former is more likely. (author) 12 refs.; 3 figs.

34423 (LA-UR–93-2300) **Improved approximations applied to the S_N even-parity equation.** Noh, Taewan, Miller, W.F. Jr.; Morel, J.E. Los Alamos National Lab., NM (United States). [1993]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-931160–5: American Nuclear Society (ANS) winter meeting, San Francisco, CA (United States), 14-19 Nov 1993). Order Number DE93016467. Source: OSTI; NTIS; GPO Dep.

We have developed various finite element differencing schemes by applying lumping techniques in neutron streaming and removal terms of the S_N even-parity transport equation in two-dimensional x-y geometry. We have derived an analytical form of the even-parity reflective boundary condition, which along with the vacuum boundary condition can be applied directly to solve second-order even-parity boundary value problems. We have also developed a new simplified even-parity equation that is much more computationally efficient than the even-parity equation. The developed schemes are numerically compared with the conventional first-order diamond-differencing (DD) scheme.

34424 (LA-UR–93-2301) **Asymptotic derivation of the modified time-dependent SP_2 equations and numerical calculations.** Shin, Uncheol; Miller, W.F. Jr.; Morel, J.E. Los Alamos National Lab., NM (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-931160–6: American Nuclear Society (ANS) winter meeting, San Francisco, CA (United States), 14-19 Nov 1993). Order Number DE93016466. Source: OSTI; NTIS; GPO Dep.

Converting the independent variables of the transport equation to dimensionless parameters, asymptotic analyses can be performed to show that, for an important class of problems, the diffusion equation is an asymptotic limit of the transport equation. A recent paper by Larsen, McGhee, and Morel provides a broadened view of the result discussed above. It deals with the steady-state transport equation and shows that the Simplified Spherical-Harmonics (SP_N) equations are robust high-order asymptotic approximations of the transport equation in a physical regime in which the conventional diffusion equation is the leading-order approximation. According to the reported numerical results for the steady-state cases, for many problems, low-order SP_N equations capture most of the transport corrections to the diffusion approximation. And Larsen shows that, in nearly all cases, the SP_2 results are significantly more accurate than diffusion results in the steady-state problems.

34425 (LA-UR–93-2429) **LAHET calculations for accelerator neutron production.** Prael, R.E. Los Alamos National Lab., NM (United States). [1993]. 6p. Sponsored by USDOE, Washington,

DC (United States). DOE Contract W-7405-ENG-36. (CONF-931160–4: American Nuclear Society (ANS) winter meeting, San Francisco, CA (United States), 14-19 Nov 1993). Order Number DE93016518. Source: OSTI; NTIS; INIS; GPO Dep.

LAHET is a Monte Carlo code for the transport and interaction of nucleons, pions, muons, fight ions, and antinucleons in complex geometry; it is the result of a major effort at Los Alamos National Laboratory to develop a code system based on the LANL version of the HETC Monte Carlo code for the transport of nucleons, pions, and muons, which was originally developed at Oak Ridge National Laboratory. The system of codes based on LAHET is designated as the LAHET Code System (LCS). LAHET, as all the variants of HETC, has been widely used over the years for design of neutron production targets, facility shielding, and experimental analysis. LAHET is now widely used for medical accelerator facility design and application. Particle tracking uses the general geometry model of the LANL MCNP code, and shares the geometry description and input of MCNP, except for lattices and/or repeated structures. HMCNP is a modification of MCNP which accepts an. external neutron/photon source created by LAHET. Neutron transport from 20 MeV to thermal and all photon/electron transport is done with HMCNP.

34426 (LA-UR–93-2582) **Comparison of energy deposition calculations by the LAHET Code System with experimental results.** Beard, C.A.; Lisowski, P.W.; Russell, G.J.; Waters, L.S. Los Alamos National Lab., NM (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930913–15: Global '93: future nuclear systems - emerging fuel cycles and waste disposal options, Seattle, WA (United States), 12-17 Sep 1993). Order Number DE93018549. Source: OSTI; NTIS; INIS; GPO Dep.

A comparison was performed between the energy deposition predicted by the LAHET Code System (LCS) with experimental values determined by Belyakov-Bodin et al. for 800, 1000, and 1200 MeV protons on targets composed of lead, bismuth, beryllium, carbon, and aluminum. The lead and bismuth showed agreement within approximately 10% at locations throughout the targets, and the agreement of the total energy deposited over the axial length of the targets ranged from 1% to 25%. For the lead and bismuth cases, the LCS predictions were always greater than the experimental results. For the lighter materials, the agreement at locations throughout the target only agreed within approximately 20%. No definable trend could be determined for the lighter materials since some LCS predictions were greater than the experimental results, some were less than the experimental results, and some showed very good agreement. The total energy deposited over the axial length of the targets was not compared for the lighter materials since it was not explicitly given with the experimental data.

34427 (ORNL/FTR–4602) **Travel to France to attend seminar on advanced Monte Carlo Computer Program for Radiation Transport: Foreign trip report, April 25–May 2, 1993.** Johnson, J.O. Oak Ridge National Lab., TN (United States). 11 May 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93014360. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The traveler attended the Organization for Economic Cooperation and Development (OECD) Nuclear Energy Agency (NEA) Seminar on Advanced Monte Carlo Computer Programs for Radiation Transport at Centre d'Etudes, Saclay, France, to present an invited paper on the recent developments and status of the Monte Carlo Adjoint Shielding Code System, MASH 1.0. The traveler also exchanged information in the use of Monte Carlo techniques with other attendees in the hope of gathering new ideas and developments for implementation into the next version of MASH to keep the ORNL MASH Code System a "state-of- the-art" computational tool for shielding design and analysis.

34428 (ORNL/FTR–4604) **Travel to France to participate in seminar on Advanced Monte Carlo Programs for Radiation Transport: Foreign trip report, April 24–May 1, 1993.** Tang, J.S. Oak Ridge National Lab., TN (United States). 17 May 1993. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93014638. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The traveler attended the Seminar on Advanced Monte Carlo Programs for Radiation Transport, April 27–29, 1993, Centre d'Etudes, Saclay, France. The seminar was attended by about 100 persons from 20 countries. A total of 59 papers were presented. A wide range of topics relating to Monte Carlo solutions to radiation shielding problems were presented. Discussions included major Monte Carlo computer programs from the United States, France, and the United Kingdom, new developments in automatic biasing techniques for variance reduction, application of vector and parallel computer architectures to Monte Carlo, and user experience and applications of the Monte Carlo method in solving various problems. The majority of the papers concerned neutron and photon transport; fewer than ten papers were related to coupled electron/photon transport and other topics. The traveler presented an invited paper entitled "Development and Application of the Automated Monte Carlo Biasing Procedure in SAS4." The talk was well received, and much feedback and discussions were generated. The traveler benefits a great deal from the standpoint of technical and professional development as a result of personal interaction and many fruitful discussions with other experts on the Monte Carlo method. Possibly some of the new ideas and innovations may be used to improve the US Department of Energy role in developing additional methods to be used in transportation

34429 (UCRL-JC–113914) **Anomalous scattering calculation of x- and gamma rays.** Roy, S.C. (Bose Inst., Calcutta (India). Dept. of Physics); Kissel, L.; Pratt, R.H. Lawrence Livermore National Lab., CA (United States). Jul 1993. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9307113–1: 16. international conference on x-ray and inner shell processes, Debrecen (Hungary), 12-16 Jul 1993). Order Number DE93018101. Source: OSTI; NTIS; GPO Dep.

Short communication. X RADIATION/scattering; GAMMA RADIATION/scattering; SCATTERING; S MATRIX; SCATTERING AMPLITUDES

6641 Theory of Electronic Structure of Atoms and Molecules

Refer also to citation(s) 34176

34430 (UCRL-JC–114326) **Relativistic configuration interaction calculation of the correlation energies of heliumlike ions.** Cheng, Kwok-Tsang (Lawrence Livermore National Lab., CA (United States)); Chen, Mau Hsiung; Johnson, W.R. Lawrence Livermore National Lab., CA (United States). Sep 1993. 4p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract W-7405-ENG-48. Grant PHY-92-04089. (CONF-9309176–1: 2. international conference on computational physics, Beijing (China), 13-17 Sep 1993). Order Number DE93018093. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication ELECTRONIC STRUCTURE/calculation methods; MULTICHARGED IONS/electronic structure; RELATIVISTIC RANGE; HAMILTONIANS; EIGENVALUES; QUANTUM ELECTRODYNAMICS; BAG MODEL

6642 Spectra of Atoms and Molecules and Their Interactions With Photons

Refer also to citation(s) 33175

34431 (INIS-RU–347, pp. 90) **Measurement of charge radii of Hf nuclei by laser resonance fluorescence method.** Anastasov, A.; Gangrskij, Yu.P.; Zemlyanoj, S.G.; Kul'dzhanov, B.K.; Marinova, K.P.; Markov, B.N. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs., 1 tab. HAFNIUM ISOTOPES/ nuclear radii; CORRECTIONS; ENERGY-LEVEL TRANSITIONS; EXPERIMENTAL DATA; LASER SPECTROSCOPY; MASS NUMBER; NUCLEAR DEFORMATION; RESONANCE FLUORESCENCE; SPECTRAL SHIFT

34432 (INIS-RU–347, pp. 179) **Tables of internal conversion coefficients in Dirac-Fock field for observed high-multipolarity nuclear transitions.** Band, I.M. (AN SSSR, Leningrad (Russian Federation). Inst. Yadernoj Fiziki); Trzhaskovskaya, M.B. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International Conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. 2 refs., 1 tab. IRIDIUM/internal conversion; ATOMS; ELECTRONIC STRUCTURE; IRIDIUM; MULTIPOLE TRANSITIONS; THEORETICAL DATA

34433 (INIS-RU–347, pp. 181) **Influence of atoms of second, third and larger coordination spheres on conversion process in metals.** Gerasimov, V.N.; Dobretsov, V.Yu.; Kulakov, V.M.; Soldatov, A.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. TECHNETIUM/internal conversion; TECHNETIUM/metals; TECHNETIUM/solid solutions; ATOMS; CRYSTALS; ELECTRONIC STRUCTURE; PLATINUM; TECHNETIUM; METALS

34434 (INIS-RU–353, pp. 15-20) **Disordered static transfer of excitation energy from the Er^{3+} ion $^4S_{3/2}$ level in $Y_3Al_5O_{12}$ and $YAlO_3$ crystals on interaction of three optically active Er^{3+} centers.** Zhekov, V.I. (AN SSSR, Moscow (Russian Federation). Inst. Obshchej Fiziki); Murina, T.M.; Prokhorov, A.M.; Studenikin, M.I.; Dzheordzhesku, Sh.; Lupej, A.; Lupej, V. AN SSSR, Moscow (Russian Federation). Fizicheskij Inst. 1991. (In Russian). In *Short communications on physics. Experimental and theoretical physics. No. 9.* 48p. Order Number DE94600071. Source: OSTI; NTIS (US Sales Only); INIS.

The time and concentration dependences of the disordered static transfer of the donor excitation energy at the elementary interaction of the donor with two ions of the acceptor, were investigated in the $Y_3Al_5O_{12}$ and $YAlO_3$ crystals. The measurements were made at 300 K and the Er^{3+} concentrations of 0.5-15%. The crystals were excited by the second harmonics of the YAG-Nd^{3+} laser. Basing on the analysis of the results obtained the conclusion is made that the interaction between Er^{3+} ions has the dipole-dipole character. It does not change with activator ion concentration increase. The data on the luminescence time and concentration dependences may be described theoretically using the approximation of black spheres.

34435 (UCRL-JC–112950) **Absorption and x-ray measurements from ultra-intense laser-plasma interactions.** Klem, D.E.; Darrow, C.; Lane, S.; Perry, M.D. Lawrence Livermore National Lab., CA (United States). 1 Mar 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930159–50: OE/LASE '93: International Society for Optical Engineering (SPIE) conference, Los Angeles, CA (United States), 16-23 Jan 1993). Order Number DE93016538. Source: OSTI; NTIS; GPO Dep.

The interaction of subpicosecond 1.06 mm laser light at intensities up to 10^{18} W/cm^2 with dense performed plasmas is investigated by measurements of the absorption of the laser light in the plasma and by measurements of the production of bremsstrahlung x-rays. Absorption measurements are made by collecting the scattered light in an Ulbricht sphere. Light scattered in the backward and specular directions is collected separately. Measurements are presented for both high and low Z targets. X-ray production is measured using a nine channel filter/scintillator spectrometer.

34436 (UCRL-JC–113498) **Analysis of neon soft x-ray spectra from short-pulse laser-produced plasmas.** Abare, A.C. (Florida Univ., Gainesville, FL (United States)); Keane, C.J.; Crane, J.K.; DaSilva, L.B.; Lee, R.W.; Perry, M.D.; Falcone, R.W. Lawrence Livermore National Lab., CA (United States). Apr 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930159–36: OE/LASE '93: International Society for Optical Engineering (SPIE) conference, Los Angeles, CA (United States), 16-23 Jan 1993). Order Number DE93014420. Source: OSTI; NTIS; INIS; GPO Dep.

We report preliminary results from the analysis of streaked soft x-ray neon spectra obtained from the interaction of a picosecond Nd:glass laser with a gas jet target. In these experiments streaked spectra show prompt harmonic emission followed by longer time duration soft x-ray line emission. The majority of the line emission observed was found to originate from Li- and Be-like Ne and the major transitions in the observed spectra have been identified. Li-like emission lines were observed to decay faster in time than Be-like transitions, suggesting that recombination is taking place. Line ratios of n=4-2 and n=3-2 transitions supported the view that these lines were optically thin and thick, respectively. The time history of Li-like Ne 2p-4d and 2p-3d lines is in good agreement with a simple adiabatic expansion model coupled to a time dependent collisional-radiative code. Further x-ray spectroscopic analysis is underway which is aimed at diagnosing plasma conditions and assessing the potential of this recombining neon plasma as a quasi-steady-state recombination x-ray laser medium.

34437 (UCRL-JC–113605) **Modelling of intense line radiation from laser-produced plasmas.** Lee, Yim T.; Gee, M. Lawrence Livermore National Lab., CA (United States). Apr 1990. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-891136–3: 9. international workshop on laser interaction and related plasma phenomena, Monterey, CA (United States), 6-10 Nov 1989). Order Number DE93018636. Source: OSTI; NTIS; GPO Dep.

In this paper, we discuss modelling of Lyman-α (i.e. Ly-α) radiation emitted from laser-produced plasmas. We are interested in the application of one of these line radiations to pump a transition of an ion in a different plasma spatially separated from the emitting source. The interest is in perturbing the plasma rather than just probing it as in some backlighting experiments. As a result of pumping, the populations of certain excited levels are inverted. The resulting gain coefficients depend strongly on the population inversion density which in turn depends on the brightness of the pump radiation. As a result, we must produce an intense bright radiation source. In addition, to pump a transition effectively, we also need a pump line with a width larger than the mismatch of the resonance since the widths of the pumped transitions are rather narrow.

6643 Collision Phenomena

Refer also to citation(s) 34449

34438 (CONF-920948–14) **Search for resonant electron transfer and double excitation in Kr^{34+} + H_2 collisions.** Zaharakis, K.E. (Western Michigan Univ., Kalamazoo, MI (United States)); Haar, R.R.; Tanis, J.A.; Clark, M.W.; Plano, V.L. Western Michigan Univ., Kalamazoo, MI (United States). [1992]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-87ER13778. From 6. international conference on physics of highly charged ions; Manhattan, KS (United States); 28 Sep - 2 oct 1992. Order Number DE93018776. Source: OSTI; NTIS; INIS; GPO Dep.

Resonant electron transfer and double excitation (RME) is a correlated electron process which is expected to occur in an ion-atom collision when electron capture is accompanied by the simultaneous excitation of two inner-shell electrons. RT2 is similar to resonant transfer excitation (RTE) in which only a single electron is excited. RT2E was investigated experimentally for 38–42 MeV/u Kr^{34} + H_2 collisions by observing x-ray emission associated with single-electron capture. No events associated with Kr K x rays

(near 13 keV were observed; however, events do occur at about twice (> 22 keV) the Kr K x-ray energy. Several possible sources of these latter x rays have been considered.

34439 (CONF-920948–15) **Cusp electron production in 75–300 keV He^+ + Ar collisions.** Plano, V.L. (Michigan State Univ., East Lansing, MI (US)); Sarkadi, L.; Zavodszky, P.; Berenyi, D.; Palinkas, J.; Gulyas, L.; Takacs, E.; Toth, L.; Tanis, J.A. Western Michigan Univ., Kalamazoo, MI (United States). [1992]. 5p. Sponsored by USDOE, Washington, DC (United States); U.S.-Hungarian Science and Technology Joint Fund; Hungarian National Scientific Research Foundation (Hungary); North Atlantic Treaty Organization, Brussels (Belgium). DOE Contract FG02-87ER13778. Grant 3011;Grant 0130/88. From 6. international conference on physics of highly charged ions; Manhattan, KS (United States); 28 Sep - 2 oct 1992. Order Number DE93018778. Source: OSTI; NTIS; INIS; GPO Dep.

Cusp-electron production has been investigated in collisions of 75–300 keV He^+ with Ar. The relative contributions from electron capture to the continuum (ECC), transfer ionization (TI), and electron loss to the continuum (ELC) to the total cusp electron production were measured. Over the energy range investigated, ECC was found to decrease from about 86% to 80%, TI decreased from about 12% to 1%, and ELC increased from about 2% to 20%. The present results are consistent with earlier work for He^+ and O^{q+} projectiles.

34440 (DOE/ER/13519–7) **Experimental study of interactions of highly charged ions with atoms at keV energies: Progress report, August 15, 1990–February 15, 1993.** Kostroun, V.O. Cornell Univ., Ithaca, NY (United States). 29 Jan 1993. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-86ER13519. Order Number DE93040222. Source: OSTI; NTIS; GPO Dep.

This final progress report summarizes the work carried out during the 29 month period from August 15, 1990 to February 15, 1993 under grant DE-FG02-86ER13519. The following experiments were done. We measured the absolute total and one- and two-electron transfer cross sections for Ar^{q+} ($8 \leq q \leq 16$) on He and H_2 at 2.3 qkeV, the angular distributions of the scattered projectiles in $Ar^{8+,9+}$ collisions, with Ar and Kr at 2.3 qkeV, the electron emissions in low energy Ar^{q+} on Ar collisions, the recoil ion charge state distributions in low energy Ar^{q+} -Ar collisions, the absolute total and one-and two-electron transfer cross sections for Ar^{8+} on Ar at 2.3 qkeV, and the absolute total and one- and two-electron transfer cross sections for Ar^{8+} on Ar as a function of energy. We also used energy gain spectroscopy to study Ar^{q+} on Ar collisions at 40 and 30 qeV, and time of flight spectroscopy to investigate ionization and dissociation of CO and N_2 in collisions with low energy, highly charged argon ions. In addition, we applied the Goldberger and Watson transition theory to derive transition rates and cross sections for atomic radiative and/or non radiative processes, wrote a computer code TRANSIT which can calculate energies, wave functions and radiative and non radiative rates for atoms and ions. The code is highly modular and can easily be modified to calculate higher order processes. Finally, we have done an Ab-Initio molecular orbital electronic energy level calculation for the $(ArAr)^{8+}$ system as a function internuclear separation.

34441 (DOE/ER/13778–6) **Correlated charge-changing ion-atom collisions: Progress report, February 16, 1990–February 15, 1993.** Tanis, J.A. Western Michigan Univ., Kalamazoo, MI (United States). Feb 1993. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-87ER13778. Order Number DE93018717. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the progress and accomplishments in accelerator atomic physics research supported by DOE grant DE-FG02-87ER13778 from February 16, 1990 through February 15, 1993. This work involves the experimental investigation of atomic interactions in collisions of charged projectiles with neutral targets or electrons, with particular emphasis on two-electron interactions and electron-correlation effects. The processes studied are of interest both from fundamental and applied points of view. In the latter case, results are obtained which are relevant to the understanding of laboratory and astrophysical plasmas, highly-excited (Rydberg) and continuum states of atoms and ions, atomic structure effects, the interaction of ions with surfaces, and the development of heavy-ion storage-rings. The results obtained have provided the basis for several M.A. thesis projects at Western Michigan and several Ph.D. dissertation projects are currently underway. Summaries of work completed and work in progress are given below in Section II. This research has resulted in 26 papers (in print and in press), 12 invited presentations at national and international meetings, and 28 contributed presentations as detailed in Section III.

34442 (LA-UR–93-2486) **Electron impact polarization and correlation properties of the inert gases.** Csanak, G. (Los Alamos National Lab., NM (United States)); Cartwright, D.C.; Machado, L.E.; Meneses, G.D. Los Alamos National Lab., NM (United States). [1993]. 29p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9307116–1: Polarization and correlation in electronic and atomic collisions, Bielefeld (Germany), 29-31 Jul 1993). Order Number DE93018358. Source: OSTI; NTIS; INIS; GPO Dep.

For the heavier rare-gas targets, Ne, Ar, Kr, there is now a reasonable amount of experimental electron impact coherence parameter data available for excitation of the lowest J = 1 states. Theoretical results for those rare-gas targets have been restricted to distorted-wave approximation (DWA) type theories. A systemization of the experimental data is presented, and they are compared with available theoretical results. In the case of the heavy rare gases, the experimental and theoretical data available for the three species, Ne, Ar, Kr, are compared in order to identify trends. The experimental data are compared with results from available theories (mainly DWA type), and the importance of spin-orbit coupling effects and "shell" effects is discussed. A physical picture that is emerging from all collisional data is presented, and future experimental and theoretical activities that will, provide new insight into the physics of these processes are recommended.

34443 (UCRL-CR–113452) **Electron impact excitation of copper atoms: Final report.** Stumpf, B.J. (Idaho Univ., Moscow, ID (United States). Dept. of Physics). Lawrence Livermore National Lab., CA (United States); Idaho Univ., Moscow, ID (United States). Dept. of Physics. [1993]. 13p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract W-7405-ENG-48. Contract B160479;Grant RII - 8902065. Order Number DE93017995. Source: OSTI; NTIS; INIS; GPO Dep.

The optical excitation function method has been used in a crossed atom and electron beam arrangement to measure the electron impact cross section of the copper $4^2P \rightarrow 4^2S$ resonance lines (324.8, 327.4 nm) from threshold (3.8 eV) to 8 eV. Relative experimental cross section data are normalized at an energy of 1000 eV with respect to first Born theory that includes the $4^2S \rightarrow 4^2P$ resonance transition with an oscillator strength of 0.652 and cascading from the $(3d^{10}nd)^2D$ states with n = 4, $\cdots$10. The measured Cu $4^2S^4 \rightarrow 4^2P$ cross section is compared with recent theoretical calculations in close-coupling approximation. Very good agreement is found with the ten-state close-coupling theory of Scheibner.

6644 Experimentally Derived Information On Atomic and Molecular Properties

Refer also to citation(s) 33782, 34165, 34438, 34443

34444 (DOE/ER/40739–1) **Laser wakefield excitation and measurement on a femtosecond time scale: Theory and experiment: Progress report, September 1, 1992–August 31, 1992.** Tajima, T.; Downer, M. Texas Univ., Austin, TX (United States). Dept. of Physics. Apr 1993. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-92ER40739. Order Number DE93013552. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. PLASMA WAVES/excitation; LASER RADIATION/photoionization; PROGRESS REPORT; EXCITATION; PHOTOIONIZATION; WAVE PROPAGATION; COMPUTERIZED SIMULATION; INTERNATIONAL COOPERATION

34445 (UCRL-JC–113768) **Harmonic generation at high intensities.** Schafer, K.J.; Krause, J.L.; Kulander, K.C. Lawrence

Livermore National Lab., CA (United States). Jun 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9208188–2: North Atlantic Treaty Organization/Advanced Studies Institute (NATO/ASI) summer school: from statistical physics to statistical inference and back, Cargese (France), 31 Aug - 12 sep 1992). Order Number DE93018632. Source: OSTI; NTIS; GPO Dep.

Atomic electrons subject to intense laser fields can absorb many photons, leading either to multiphoton ionization or the emission of a single, energetic photon which can be a high multiple of the laser frequency. The latter process, high-order harmonic generation, has been observed experimentally using a range of laser wavelengths and intensities over the past several years. Harmonic generation spectra have a generic form: a steep decline for the low order harmonics, followed by a plateau extending to high harmonic order, and finally an abrupt cutoff beyond which no harmonics are discernible. During the plateau the harmonic production is a very weak function of the process order. Harmonic generation is a promising source of coherent, tunable radiation in the XUV to soft X-ray range which could have a variety of scientific and possibly technological applications. Its conversion from an interesting multiphoton phenomenon to a useful laboratory radiation source requires a complete understanding of both its microscopic and macroscopic aspects. We present some recent results on the response of single atoms at intensities relevant to the short pulse experiments. The calculations employ time-dependent methods, which we briefly review in the next section. Following that we discuss the behavior of the harmonics as a function of laser intensity. Two features are notable: the slow scaling of the harmonic intensities with laser intensity, and the rapid variation in the phase of the individual harmonics with respect to harmonic order. We then give a simple empirical formula that predicts the extent of the plateau for a given ionization potential, wavelength and intensity.

34446 (UCRL-JC–114575) **Electrical conductivity of hydrogen shocked to megabar pressures.** Weir, S.T.; Nellis, W.J.; Mitchell, A.C. Lawrence Livermore National Lab., CA (United States). Aug 1993. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930676–46: 14. international conference of the International Association for the Advancement of High Pressure Science and Technology, Colorado Springs, CO (United States), 27 Jun - 2 jul 1993). Order Number DE93019632. Source: OSTI; NTIS; INIS; GPO Dep.

The properties of ultra-high pressure hydrogen have been the subject of much experimental and theoretical study. Of particular interest is the pressure-induced insulator-to-metal transition of hydrogen which, according to recent theoretical calculations, is predicted to occur by band-overlap in the pressure range of 1.5-3.0 Mbars on the zero temperature isotherm. Extremely high pressures are required for metallization since the low-pressure band gap is about 15 eV. Recent static-pressure diamond anvil cell experiments have searched for evidence of an insulator-to-metal transition, but no conclusive evidence for such a transition has yet been supplied. Providing conclusive evidence for hydrogen metallization is difficult because no technique has yet been developed for performing static high-pressure electrical conductivity experiments at megabar pressures. The authors report here on electrical conductivity experiments performed on H_2 and D_2 multi-shocked to megabar pressures. Electrical conductivities of dense fluid hydrogen at these pressures and temperatures reached are needed for calculations of the magnetic fields of Jupiter and Saturn, the magnetic fields being generated by convective dynamos of hot, dense, semiconducting fluid hydrogen. Also, since electrical conduction at the pressure-temperature conditions being studied is due to the thermal excitation of charge carriers across the electronic band gap, these experiments yield valuable information on the width of the band gap at high densities.

6645 Special Atoms and Molecules

34447 (DOE/NV/10872–T61) **Studies of clusters: Fourth quarterly technical progress report, April 1, 1993–June 30, 1993.** Farley, J.W. Nevada Univ., Las Vegas, NV (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC08-90NV10872. Order Number DE93018961. Source: OSTI; NTIS; GPO Dep.

Positive cluster ions were produced, and the mass spectrum was measured using a radiofrequency quadrupole mass spectrometer. Mass spectra are attached, showing the cluster ions produced using pure ammonia. They have the general formula $(NH_3)_nH_m^+$, where n and m are integers. Peaks with different numbers of hydrogens can barely be resolved. This shows that the ion source can produce cluster ions. The development of sensitive laser techniques is necessary for probing the clusters. During this quarter, we succeeded in using a weak diode laser was used to probe a bean of negative molecular ion. The work on the visible absorption spectrum of D_2O^+ continues, and is now in the analysis phase. The work on the infrared vibrational – rotational spectrum of $H^{15}NO^-$ continues. In the second ion beam machine, a complete reworking of the voltages has been completed, and is being reassembled.

34448 (INIS-RU–347, pp. 184) **Orthopositronium decay accompanied by excitation of nucleus or atomic shell.** Fedotkin, S.N. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Kolomiets, V.M. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. POSITRONIUM/annihilation; POSITRONIUM/decay; CROSS SECTIONS; E1-TRANSITIONS; LIFETIME; NUCLEI; POSITRONIUM; ANNIHILATION; DECAY; PROBABILITY; RADIATIONLESS DECAY

34449 (INIS-RU–347, pp. 192) **Orthopositronium decay stimulated by laser radiation.** Berestov, A.V. (AN Belorusskoj SSR, Minsk (Belarus). Inst. Fiziki); Galynskij, M.V.; Rudak, Z.A.; Sikach, S.M. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. POSITRONIUM/annihilation; POSITRONIUM/laser radiation; MULTI-PHOTON PROCESSES; PHOTON-ATOM COLLISIONS; POSITRONIUM; ANNIHILATION; PROBABILITY; TOTAL CROSS SECTIONS

34450 (INIS-RU–347, pp. 197) **Dependence of muon E0 conversion probability on nuclear models.** Lavrenov, A.N. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs. MUONIC ATOMS/e0-transitions; MUONIC ATOMS/internal conversion; ALGEBRAIC CURRENTS; E0-TRANSITIONS; MUONS; NUCLEAR MODELS; PROBABILITY

34451 (INIS-RU–347, pp. 407) **Positrons sound superconductivity.** Prokop'ev, E.P. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. 4 refs. HIGH-TC SUPERCONDUCTORS/positrons; ANNIHILATION; CUPRATES; ELECTRON DENSITY; POSITRONS; SUPERCONDUCTIVITY; WAVE FUNCTIONS

34452 (INIS-RU–347, pp. 408) **On positron states in superconductor superlattices.** Prokop'ev, E.P. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. 5 refs. SUPERLATTICES/positrons; ANGULAR DISTRIBUTION; ANNIHILATION; ELECTRON DENSITY; LIFETIME; SEMICONDUCTOR DETECTORS; SUPERLATTICES; POSITRONS

6650 Physics of Condensed Matter

Refer also to citation(s) 33154, 33204, 33375, 33424, 33454, 33699, 34006

34453 (ANL/MSD/CP–79602) **Phenomenological explanation of elastic anomalies in superlattices.** Grimsditch, M. (Argonne National Lab., IL (United States)); Fullerton, E.E.; Schuller, I.K. Argonne National Lab., IL (United States). Jun 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930405–32: Spring meeting of the Materials Research Society, San Francisco, CA (United States), 12-16 Apr 1993). Order Number DE93017475. Source: OSTI; NTIS; GPO Dep.

The experimental fact that measured elastic and structural properties of superlattices are strongly correlated can be understood on the basis of a simple model based on the packing of hard spheres. The model is consistent with features of many models that have been proposed to explain the supermodulus effect; but contrary to previous explanations, it allows predictions for a given pair of constitutents to be made. For an arbitrary pair of elements, it predicts the existence or non-existence of an elastic anomaly, and a rough estimate of its magnitude.

34454 (BUP–1992-04) **Nucleation of relativistic first-order phase transitions.** Csernai, L.P. (Bergen Univ., Dept. of Physics (Norway)); Kapusta, J.I. Bergen Univ. (Norway). Dept. of Physics. 1992. 36p. Order Number DE94600533. Source: OSTI; NTIS; INIS.

The authors apply the general formalism of Langer to compute the nucleation rate for systems of relativistic particles with zero or small baryon number density and which undergo first-order phase transitions. In particular, the pre-exponential factor is computed and it is proportional to the viscosity. The initial growth rate of a critical size bubble or droplet is limited by the ability of dissipative processes to transport latent heat away from the surface. 30 refs., 4 figs.

34455 (CONF-9302137–1) **Study of ±J Ising spin glasses via multicanonical ensemble.** Celik, T. (Florida State Univ., Tallahassee, FL (US). Supercomputer Computations Research Inst.); Hansmann, U.H.E.; Berg, B. Florida State Univ., Tallahassee, FL (United States). Supercomputer Computations Research Inst. Mar 1993. 4p. Sponsored by USDOE, Washington, DC (United States); Deutsche Forschungsgemeinschaft, Bonn (Germany); TUBITAK (Turkey). DOE Contract FG05-87ER40319 ;FC05-85ER25000. (FSU-SCRI–93-31). From 6. annual workshop on recent developments in computer simulation studies in condensed matter physics; Athens, GA (United States); 22-26 Feb 1993. Order Number DE93018269. Source: OSTI; NTIS; INIS; GPO Dep.

The authors performed numerical simulations of 2D and 3D Edwards-Anderson spin glass models by using the recently developed multicanonical ensemble. The ergodicity times increase with the lattice size approximately as V^3. The energy, entropy and other physical quantities are easily calculable at all temperatures from a single simulation. Their finite size scalings and the zero temperature limits are also explored.

34456 (LA-UR–93-2692) **High pressure metallization of Mott Insulators: Magnetic, structural and electronic properties.** Pasternak, M.P. (Tel Aviv Univ. (Israel)); Hearne, G.; Sterer, E.; Taylor, R.D.; Jeanloz, R. Los Alamos National Lab., NM (United States). 20 Jul 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930676–30: 14. international conference of the International Association for the Advancement of High Pressure Science and Technology, Colorado Springs, CO (United States), 27 Jun - 2 jul 1993). Order Number DE93018295. Source: OSTI; NTIS; INIS; GPO Dep.

High pressure studies of the insulator-metal transition in the $(TM)I_2$ (TM = V, Fe, Co and Ni) compounds are described. Those divalent transition-metal iodides are structurally isomorphous and classified as Mott Insulators. Resistivity, X-ray diffraction and Moessbauer Spectroscopy were employed to investigate the electronic, structural, and magnetic properties as a function of pressure both on the highly correlated and on the metallic regimes.

34457 (SAND–93-1395C) **A mixture model for shock compression of porous multi-component reactive materials.** Baer, M.R. Sandia National Labs., Albuquerque, NM (United States). 1993. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930676–9: 14. international conference of the International Association for the Advancement of High Pressure Science and Technology, Colorado Springs, CO (United States), 27 Jun - 2 jul 1993). Order Number DE93017638. Source: OSTI; NTIS; INIS; GPO Dep.

A multiphase mixture model is presented to describe shock compression of highly porous, multi-component powders. Volume fractions are represented as independent kinematic variables and thermodynamically-admissible phase interaction constitutive models are formulated in the context of a three phase system. Numerical solutions of the multiphase flow equations simulated impact on a porous layer of mixed powders of Al and Fe_2O_3. The multiphase model predicts dispersive compaction waves which have features similar to observed time-resolved pressure measurements.

6651 Nuclear Techniques In Condensed Matter Physics

Refer also to citation(s) 33144, 33211, 33246, 33551, 34434, 34451, 34452

34458 (BNL–70343) **Trip to France for a Workshop on Fluorescence Microprobe Beamline at the ESRF: Foreign trip report, April 3–10, 1993.** Jones, K.W. Brookhaven National Lab., Upton, NY (United States). 6 May 1993. 34p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE93014797. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A Workshop on Fluorescence Microprobe Beamline at ESRF was held to discuss design considerations for the beam line. Topics considered included descriptions of approaches taken at existing facilities, characteristics of insertion devices, monochromators and focussing instrumentation, fluorescence detection, and layout of the beam line. A detailed proposal for the beam line based on the Workshop discussions will be prepared and submitted to the ESRF Scientific Advisory Committee and ESRF administration for final approval. A start date of 1995 was estimated for installation at the ESRF ring.

34459 (CONF-9304183–1) **Diffraction tomographic signal processing algorithms for tunnel detection.** Witten, A.J. Oak Ridge National Lab., TN (United States). [1993]. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 4. tunnel detection symposium; Golden, CO (United States); 26-29 Apr 1993. Order Number DE93018455. Source: OSTI; NTIS; GPO Dep.

Signal processing algorithms have been developed for wave based imaging using diffraction tomography. The basis for this image reconstruction procedure is the generalized projection slice theorem (GPST) which, for homogeneous waves, is an analytic relationship between the spatial Fourier transform of the acquired data and the spatial Fourier transform of the spatial profile (object function) of the object being imaged. Imaging within geophysical

diffraction tomography when only homogeneous waves are considered can then be accomplished by inversion of the GPST using standard numerical techniques. In an attenuating background medium or when eddy currents or static fields are considered, a generalized GPST can be derived that involves both real and complex spatial frequencies. In this case, direct Fourier inversion is not possible because of the presence of the complex frequencies. Although direct inversion and, hence, complete imaging is not possible for such cases, the generalized CPST'S can be used to analytically shift the location of data templates matched to specified targets and these templates can, in turn, be correlated with acquired data to detect and estimate the location of the specified targets. Since GPST's are used directly in the detection problem, there is no need to numerically invert the intergal transform of the object function. For this reason, target detection can be accomplished in a computationally efficient manner independent of the type of measurement or background geologic conditions. A number of GPST's are derived and the use of GPST's for both imaging and detection of subsurface voids is demonstrated in several recent applications.

34460 (DOE/ER/45199–3) **[Gamma scattering in condensed matter with high intensity Moessbauer radiation]: Progress report.** Purdue Univ., Lafayette, IN (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-85ER45199. Order Number DE93019461. Source: OSTI; NTIS; INIS; GPO Dep.

The first Moessbauer studies of diffusion in liquid state was carried out using ^{183}Ta ME sources. Liquids studied included pentadecane, polydimethylsiloxane in benzene, and glycercol. Recoilless fractions and Debye-Waller factors were measured. Because of the results of Schecter, we remeasured the ME for dilute tin in lead; no no anomalous cutoff was found in the Debye-Waller factor over 4-300 K, and there was a large broadening in the linewidth for 1.6 at.% (50% at 4.5 K). Advances in ME method are described.

34461 (DOE/ER/45324–T3) **Statics and dynamics in systems with frustration and or randomness: Progress report, 1993.** Belanger, D.P. California Univ., Santa Cruz, CA (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-87ER45324. Order Number DE93018307. Source: OSTI; NTIS; GPO Dep.

Over the past year we have finished some projects as anticipated in our recent three year proposal, and we have started some new projects, some of which were not anticipated in our proposal. I will describe briefly our status with regard to students first. Then I will report on the current equipment situation in our UCSC labs. The projects completed or very close to being completed will be described. Projects which we are currently pursuing will be described next. Finally, our proposed budget, only slightly modified from the one in the proposal, will be justified. The budget itself is detailed at the end of this report All manuscripts published since the recent proposal was submitted are included with this progress report.

34462 (DOE/FTR–93014002) **Participation in the 3rd International conference on Ion microprobe research and technology: Foreign trip report, June 6–19, 1992.** Pontau, A.E. Sandia National Labs., Livermore, CA (United States). 15 Jul 1992. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DR00789. Order Number DE93014002. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of this trip was to improve Sandia's capability to conduct ion microbeam analysis for DP Programs and to publicly report our earlier measurements and present capabilities. I lead the Ion Microanalysis Group (IMAG) which consists of a total of about a dozen staff from both Sandia and Lawrence Livermore labs. We operate two microbeam analysis lines. There were three distinct phases of this trip with respect to development of IMAG's capabilities. The first portion of the trip consisted of participation in the 3rd International Conference on Nuclear Microprobe Technology and Applications including presenting one invited talk, one contributed poster, and chairing one technical session. The conference attracts the best Ion Microprobe scientists in the world to discuss the development of the microbeam techniques and equipment as well as representative applications. The second portion of the trip involved visiting two labs in Germany that employ ion beam techniques that may be adapted to our microbeam facility. The Germans use these techniques with millimeter-scale beams; we are exploring utilizing these tools on the micron scale. The third portion of the trip centered on evaluating the utility of a particular lens system used at Oxford with respect to installation on a new beamline in our lab. Questions existed as to whether their lens would be suitable for us because of our capability to operate with high-energy protons and heavy ions not available in most microbeam materials analysis labs. While in Oxford, I conducted several ray-tracing calculations with their staff, discussed likely operating scenarios and concluded that a particular lens system-model OM-150 would be most appropriate for IMAG. This process was completed in one full day instead of the two planned, allowing earlier return to the US.

34463 (INIS-mf–13549, pp. 113-121) **Neutron spectrometry of a bound multiphonon vibration as a method for study of impurities and radiation defects diffusion in metal.** Agranovich, V.M. (AN SSSR, Troitsk (Russian Federation). Inst. Spektroskopii); Dubovskij, O.A. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 10.* 214p. Order Number DE94600067. Source: OSTI; NTIS (US Sales Only); INIS.

The review of experimental and theoretical investigations of anharmonic vibrations in crystals is presented. The anharmonic vibrations of atoms cause an optical phonons interaction so the generation of the bound multiphonon complexes (bi phonon, tri phonon, etc.) is possible. The spectral terms of these complexes that are located on impurities are the best spectrometric indicators for defect formation process. These vibrations determine the atom diffusion parameter because their energies are approximately the same as the barrier height for the diffusion. 24 refs.; 1 fig. (author).

34464 (INIS-RU–347, pp. 389-390) **Magnetic hyperfine fields on ^{181}Ta nuclei in $GdFe_2$ samples crystallized under high pressure from 3.0 to 6.3 GPa.** Sorokin, A.A. (Moskovskij Gosudarstvennyj Univ., Moscow (Russian Federation). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Ryasnyj, G.K.; Komissarova, B.A.; Krylov, V.I.; Shpin'kova, L.G.; Shirani, E.N.; Tsvyashchenko, A.V.; Fomicheva, L.N.; Panova, TAN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. 1 ref., 1 tab. GADOLINIUM ALLOYS/electronic structure; IRON ALLOYS/electronic structure; CRYSTALLIZATION; CRYSTALS; DIFFERENTIAL PAC; HYPERFINE STRUCTURE; INTERMETALLIC COMPOUNDS; MAGNETIC FIELDS; PRESSURE DEPENDENCE; TANTALUM 181; VERY HIGH PRESSURE

34465 (INIS-RU–347, pp. 429) **Positron annihilation process using for porous size determination.** Batkin, I.S. (Voronezhskij Gosudarstvennyj Univ., Voronezh (Russian Federation)); Bushakhma, Kh.A.; Churakova, T.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. DIAGNOSTIC TECHNIQUES/annihilation; DIAGNOSTIC TECHNIQUES/positrons; POROUS MATERIALS/diagnostic techniques; DENSITY; ANNIHILATION; POSITRONS; DIMENSIONS; EFFECTIVE CHARGE; PHOTON EMISSION; POROSITY; SIMULATION; SIZE; SOLIDS

34466 (INIS-RU–347, pp. 437) **Determination of electric field gradient in palladium hydrides by ^{60}Co impurity nuclei orientation method.** Gurevich, G.M. (AN SSSR, Moscow (Russian Federation). Inst. Yadernykh Issledovanij); Topalov, S.V.; Shishkin, D.L.; Erzinkyan, A.L.; Parfenova, V.P.; Pavlov, V.N. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

Printed by 'Nauka', S.-Petersburg' division.

Short communication. PALLADIUM HYDRIDES/crystal field; PALLADIUM HYDRIDES/electric fields; PALLADIUM HYDRIDES/spatial distribution; ANGULAR DISTRIBUTION; COBALT ADDITIONS; COBALT 60; CRYSTAL LATTICES; DIAGNOSTIC TECHNIQUES; GAMMA RADIATION; HYPERFINE STRUCTURE; ORIENTED NUCLEI; POLYCRYSTALS

34467 (LA-UR–93-2556) **Older muons are wiser: Using time information in μLCR spectroscopy.** Leon, M. Los Alamos National Lab., NM (United States). 19 May 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9306228–1: 6. international conference on muon spin rotation/relaxation/resonance, Maui, HI (United States), 7-11 Jun 1993). Order Number DE93018556. Source: OSTI; NTIS; INIS; GPO Dep.

For μLCR with slow polarization transfer, the weak resonance signals can be strengthened by delaying the positron observation period, for pulsed and chopped muon beams. Furthermore, the sensitivity to drifts can be reduced or eliminated by using the ratios of late to early e^+ counts. These possibilities for using time information are discussed quantitatively.

34468 (LIU-TEK-LIC–1993-11) **Electrical properties of InP/InGaAs heterojunction bipolar transistors.** Linkoeping Studies in Science and Technology. Ouacha, A. Linkoeping Univ. (Sweden). Dept. of Physics and Measurement Technology. May 1993. 33p. Order Number DE94600534. Source: OSTI; NTIS; INIS.

In recent years, there has been considerable interest in indium phosphide (InP) and In-based III-V compounds because of their applications in many electronic and photonic devices. The issues involved in processing high quality InP-based devices have been widely explored during the last decade. Realization of highly reliable, high speed, and long distance fiber-optics communication systems requires good quality of the material growth, characterization techniques and reproducible device processing concepts. All these three elements should be included in the manufacturing sequence in order to produce devices of high quality. Until recently, most of the InP related technologies and advances have been focused around optical fiber communications (1.3-1.55 μm) where Si and GaAs could not compete. The main obstacle to rapid growth of InP based technology in the 80s was the enormous investment and interest of large companies and commercial research organizations in GaAs technology. Supporting and financing InP related devices and material was at best minimal. As a consequence, there has been a much slower perhaps more realistic development curve for non-optical InP-based devices and technologies. InP technology has survived solely on the basic of its technical performance, despite the financial problems. In this thesis, we investigate the static behaviour of InP/InGaAs heterojunction bipolar transistors (HBTs) which have attracted a significant amount of attention. (20 refs., 5 figs., 3 tabs.).

34469 (ORNL/FTR–4645) **Travel to France to participate in an x-ray microprobe experiment at the European Synchrotron Radiation Facility and to discuss developments in x-ray optics and beamline control programs: Foreign trip report, May 19–26, 1993.** Ice, G.E. Oak Ridge National Lab., TN (United States). 9 Jun 1993. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93016209. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The European Synchrotron Radiation Facility (ESRF) is the first of the third-generation synchrotron radiation facilities. This impressive x-ray source is operating ahead of schedule with desip emittance and with better than desip current. The combination of small source size and collimated beams from third-generation sources make them attractive for the development of x-ray microprobe capabilities. At the ESRF the low beta insertion devices are particularly attractive for microfocusing with modest focal length optics. This trip provided an opportunity to test x-ray microfocusing optics on a third-generation source. Some simple measurements were made to illustrate the applications of an advanced x-ray microprobe to materials problems. The trip also afforded an opportunity to experience and discuss the performance of recent x-ray optical developments with ESRF scientists and to evaluate and discuss beamline computer control software with ESRF computer scientists.

34470 (ORNL/TM–12223) **Atom probe field ion microscopy and related topics: A bibliography 1991.** Russell, K.F.; Miller, M.K. Oak Ridge National Lab., TN (United States). Jan 1993. 42p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93019104. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains a bibliography for 1991 on the following topics: Atom probe field ion microscopy; field desorption mass spectrometry; field emission; field ion microscopy; and field emission theory.

34471 (PNL-SA–21961) **Fourier transform ion cyclotron resonance versus time of flight for precision mass measurements.** Kouzes, R.T. Pacific Northwest Lab., Richland, WA (United States). Feb 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930274–4: Workshop on traps for antimatter and radioactive nuclei, Vancouver (Canada), 25-27 Feb 1993). Order Number DE93019170. Source: OSTI; NTIS; INIS; GPO Dep.

Both Fourier Transform Ion Cyclotron Resonance and ICR Time-of-Flight mass spectroscopy (FTICR-MS and ICR-TOF-MS, respectively) have been applied to precision atomic mass measurements. This paper reviews the status of these approaches and compares their limitations. Comparisons are made of FTICR-MS and ICR-TOF-MS for application to precision atomic mass measurements of stable and unstable nuclei, where the relevant scale is an accuracy of 1 keV and where halflives are longer than 10 milliseconds (optimistically). The atomic mass table is built up from mass chains, and ICR-MS brings a method of producing new types of mass chains to the mass measurement arena.

34472 (UCRL-JC–111857) **High resolution tomography of objects with access to a single side.** Thoe, R.S. Lawrence Livermore National Lab., CA (United States). 24 Mar 1993. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930445–20: Society of Photo-Optical Instrumentation Engineers (SPIE) OE/aerospace science and sensing meeting, Orlando, FL (United States), 11-16 Apr 1993). Order Number DE93017992. Source: OSTI; NTIS; GPO Dep.

The author is developing a technique which will enable one to obtain high-contrast, high-spatial resolution, three-dimensional images in opaque objects. The only constraint will be the radiation source and detector(s) will be located on the same side of the object. The goal is to obtain images with a spatial resolution of ~1 mm at depths of 10 mm and ~3 mm at depths of 30 mm in materials of moderate density (brass, steel, etc.). The author's technique uses a highly-collimated beam of monochromatic gamma rays and a slit collimated high-resolution, high-efficiency, coaxial germanium spectrometer. If the geometry is well known, the spectrum of Compton scattered radiation can be used to map out the density as a function of depth. By scanning the object in two dimensions, a full three-dimensional image of the electron density can be reconstructed. The resolution is dependent on the incident beam collimation and the energy resolution of the spectrometer. For his system, the author anticipates a resolution of about 1 mm^3. The apparatus, reconstruction algorithms and current data verifying his predictions are presented here. Also included are the details on how the system can be modified to increase the efficiency by over two orders of magnitude. This system will have several advantages over conventional transmission radiographic and tomographic systems: (1) It requires the use of a high specific intensity isotopic source of modest activity (< 100 mCi). (2) It requires only a single

high-resolution spectrometer used in conjunction with an array of low-resolution detectors (all readily available). (3) It allows for the recording of three-dimensional images of object even though both detector and source are located on the same side of the object.

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Refer also to citation(s) 33144, 33596, 34047, 34426

34473 (INIS-mf–13548, pp. 138-141) **Transmutation doping of semiconductor materials and high-temperature superconductors using the charged particles.** Shustrov, V.A. (AN SSSR, Leningrad (Russian Federation). Fiziko-Tekhnicheskij Inst.); Didik, V.A.; Kozlovskij, V.V.; Malkovich, R.Sh.; Skoryatina, E.A. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 9.* 225p. Order Number DE94600002. Source: OSTI; NTIS (US Sales Only); INIS.

The concentration profiles of the radioactive isotopes produced by the nuclear reactions in GaAs and in high-temperature superconductor $YBa_2Cu_3O_7$ irradiated by alpha-particles with energy 12, 16 and 20 MeV are determined. The fluences were 10^{15} - $10^{16}cm^{-2}$. The concentration of the isotopes (^{72}As,^{73}As,^{74}As,^{77}Br in the case of GaAs, ^{66}Ga,^{67}Ga,^{67}Cu,^{92}Nb,^{140}Ba,^{141}Ce in the case of $YBa_2Cu_3O_7$) is of order 10^{13}-$10^{14}cm^{-3}$, the depth of the profile being in the range 20-100μm depending upon the energy: the depth increases with energy. The specific feature of some profiles (^{72}As,^{74}As,^{92}Nb) is found, namely the existence of the maximum. This feature is interpreted as a consequence of the non-monotonous energy dependence of the nuclear reaction cross-section. 5 refs.; 4 figs. (author).

34474 (INIS-mf–13548, pp. 147-153) **The study of structure imperfections in irradiated cadmium diphospide.** Girka, A.I. (Kievskij Pedagogicheskij Inst., Kiev (Ukraine)); Kosyak, S.V.; Kuts, V.I.; Tartachnik, V.P.; Tychina, I.I. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 9.* 225p. Order Number DE94600002. Source: OSTI; NTIS (US Sales Only); INIS.

The near edge band absorption and positron annihilation (lifetime τ) in α-particle (E=35 MeV, Φ=10^{17}-$10^{18}cm^{-2}$) irradiated cadmium diphosphide single crystals were researched. Defected destructure of near edge band absorption contacts with rise of state density tails in bandgap of the semiconductor. Multiplicity of annealing stages caused by large number of radiation violation types in crystal with compound lattice. The main annealing stage (200-300^{0}C) caused by compound vacancy defects destruction; the vacancy voids disappear at T>350^{0}C. 11 refs.; 3 figs. (author).

34475 (INIS-RU–347, pp. 392) **Orientation dependence of ^{19}F nucleus E1 and E2 multipolarity level Coulomb excitation cross section relationships in crystals.** Pivovarov, Yu.L. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 1 ref. MONOCRYSTALS/coulomb excitation; CROSS SECTIONS; E1-TRANSITIONS; E2-TRANSITIONS; FLUORINE 19 BEAMS; IMPACT PARAMETER; INCIDENCE ANGLE; MONOCRYSTALS; ORIENTATION

34476 (INIS-RU–347, pp. 393) **Coulomb excitation of E1 and E2 transitions in ^{19}F nucleus of LIF crystal by protons and antiprotons.** Pivovarov, Yu.L.; Shirokov, A.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. LITHIUM FLUORIDES/coulomb excitation; ANTIPROTON BEAMS; CROSS SECTIONS; E1-TRANSITIONS; E2-TRANSITIONS; FLUORINE 19; IMPACT PARAMETER; INCIDENCE ANGLE; MONOCRYSTALS; ORIENTATION; PROTON BEAMS

34477 (INIS-RU–347, pp. 394) **Radiation-induced current-transport in metal-dielectric-semiconductor structures.** Kadmenskij, S.G. (Voronezhskij Gosudarstvennyj Univ., Voronezh (Russian Federation)); Levin, M.N.; Litmanovich, V.I.; Tatarintsev, A.V.; Chernyshev, V.E. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. MOS TRANSISTORS/physical radiation effects; MOS TRANSISTORS/semiconductor junctions; ALUMINIUM; CHARGE TRANSPORT; ELECTRIC CHARGES; ELECTRIC CONDUCTIVITY; ELECTRON BEAMS; KEV RANGE 10-100; RADIATION DOSES; RELAXATION; SILICON; SILICON OXIDES; X RADIATION

34478 (INIS-RU–347, pp. 395-396) **Unified mechanism of changes of radiation-induced surface state spectrum and oxide charge in Si-SiO_2 system.** Kadmenskij, S.G. (Voronezhskij Gosudarstvennyj Univ., Voronezh (Russian Federation)); Levin, M.N.; Litmanovich, V.I.; Tatarintsev, A.V.; Chernyshev, V.E. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. SILICON/physical radiation effects; SILICON OXIDES/physical radiation effects; ANNIHILATION; CHARGE CARRIERS; INTERFACES; IONIZING RADIATIONS; MOS TRANSISTORS; RADIATION DOSES; SILICON; SURFACE PROPERTIES

34479 (INIS-RU–347, pp. 398) **Energy dependence of proton slowing-down cross section in high-Tc superconductor.** Dzhassim, M.N. (Kievskij Gosudarstvennyj Univ., Kiev (Ukraine)); Krasheninnikov, V.D.; Shevchenko, V.A. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs., 1 tab. HIGH-TC SUPERCONDUCTORS/backscattering; HIGH-TC SUPERCONDUCTORS/bremsstrahlung; BARIUM COMPOUNDS; CROSS SECTIONS; CUPRATES; ENERGY DEPENDENCE; BACKSCATTERING; BREMSSTRAHLUNG; KEV RANGE 10-100; KEV RANGE 100-1000; PROTON BEAMS; SUPERCONDUCTING FILMS; YTTRIUM COMPOUNDS

34480 (INIS-RU–347, pp. 400) **Ion implantation in semiconductors at high temperatures.** Zhukovskij, P.V. (Joint Inst. for Nuclear Research, Dubna (Russian Federation)); Monchka, D.; Yushkevich, Yu.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on

nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs. ION IMPLANTATION/silicon; AMORPHOUS STATE; ANNEALING; ARGON IONS; CRYSTAL DEFECTS; SILICON; KEV RANGE 10-100; MONOCRYSTALS; PHYSICAL RADIATION EFFECTS; TEMPERATURE DEPENDENCE

34481 (INIS-RU–347, pp. 422) **Gamma radiation induced centers in quartz glass.** Mokrushin, A.D. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. QUARTZ/color centers; QUARTZ/physical radiation effects; ABSORPTION SPECTRA; AMORPHOUS STATE; ANNIHILATION; CROSS SECTIONS; ELECTRON CAPTURE; GAMMA RADIATION; LIFETIME; POSITRONS; QUARTZ; ULTRAVIOLET SPECTRA

34482 (INIS-RU–347, pp. 438) **Study of energy dependence of B type pair coherent production in Ge crystal.** Andreyashkin, M.Yu. (Tomskij Politekhnicheskij Inst., Tomsk (Russian Federation). Inst. Yadernoj Fiziki, Ehlektroniki i Avtomatiki); Vorob'ev, S.A.; Zabaev, V.N.; Kalinin, B.N.; Kunashenko, Yu.P.; Pivovarov, Yu.L. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 3 refs., 2 figs. GERMANIUM/pair production; GERMANIUM/photoproduction; ELECTRON PAIRS; GAMMA RADIATION; GERMANIUM; PHOTOPRODUCTION; MEV RANGE 100-1000; MONOCRYSTALS; ORIENTATION

34483 (INIS-RU–347, pp. 439) **Investigation of positron generation by radiation during channeling.** Amosov, K.Yu. (Tomskij Politekhnicheskij Inst., Tomsk (Russian Federation). Inst. Yadernoj Fiziki, Ehlektroniki i Avtomatiki); Balayan, A.S.; Vnukov, I.E.; Kalinin, B.N.; Naumenko, G.A.; Potylitsyn, A.P.; Sarychev, V.P. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. ELECTRON CHANNELING/tungsten; TUNGSTEN; MEV RANGE 01-10; MEV RANGE 10-100; MEV RANGE 100-1000; MONOCRYSTALS; ORIENTATION; POSITRON BEAMS; SPECTRA

34484 (KURRI-TR–368) **Radiation-induced structural changes, (2).** Ogasawara, M. (Hokkaido Univ., Sapporo (Japan). Faculty of Engineering); Matsuyama, T. (eds.). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Nov 1992. 102p. (In Japanese). Order Number DE93520314. Source: OSTI; NTIS; INIS.

This seminar is aimed at understanding both the physical and chemical aspects of the structural changes of materials induced by photons or ionizing radiation. The seminar was held on December 19th, 1991 and from February 13 to 14th, 1992 in this institute. The most active areas of the material science, in addition to the previous subjects, such as organic superconductors, silicon-based polymers, and fullerenes were included in this seminar. (J.P.N.).

6654 Quantum Physics Aspects of Condensed Matter

34485 (ANL/MSD/CP–80489) **Crossover between BCS and performed-Boson theories with increasing interactions.** Randeria, M. Argonne National Lab., IL (United States). Aug 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930865–1: International conference on strongly correlated electron systems, La Jolla, CA (United States), 16-19 Aug 1993). Order Number DE93019018. Source: OSTI; NTIS; INIS; GPO Dep.

The author reviews recent work on Fermi systems with attractive interactions of arbitrary strength. First, he describes the results of a functional integral formulation to study the crossover from cooperative Cooper pairing to independent bound state formation and condensation. The inadequacy of a saddle point approximation with increasing coupling is pointed out, and the importance of temporal (quantum) fluctuations for normal state properties at intermediate and strong coupling is emphasized. Next, results from a quantum Monte Carlo simulation of the 2D attractive Hubbard model are described. The intermediate coupling normal state is found to deviate markedly from a canonical Fermi liquid: "spin-gap" behavior, with $1/T_1T \sim \chi(T)$, is found in a degenerate Fermi system.

665410 Superconductivity

Refer also to citation(s) 32803, 32804, 33215, 33231

34486 (ANL/ET/CP–78928) **Fabrication and characterization of high-T_c tapes and coils made from Ag-clad Bi-2223 superconductors.** Balachandran, U. (Argonne National Lab., IL (United States)); Iyer, A.N.; Youngdahl, C.A.; Motowidlo, L.R.; Hoehn, J.G. Jr.; Haldar, P. Argonne National Lab., IL (United States). Jul 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9308122–1: 3. international conference on advanced materials, Tokyo (Japan), 31 Aug - 4 sep 1993). Order Number DE93018615. Source: OSTI; NTIS; GPO Dep.

Prereacted Pb-doped Bi-Sr-Ca-Cu-0 powders were packed into Ag tubes, drawn, rolled, and given intermediate heat treatment to prepare long lengths of Ag-clad Bi-2223 superconductor tapes. With the use of improved process conditions, transport critical current density (J_c) values exceeding 10^5 A/cm^2 at 4.2 K and 27 K, and greater than 4×10^4 A/cm^2 at 77 K, were obtained in zero applied field with short tape samples. Detailed microstructural analysis and J_c measurements in applied fields up to 20 T are reported. Rolled tapes were cut into lengths of up to 10 m, and several such tapes were used in parallel to fabricate small superconducting pancake coils by the "wind-and-react" technique. Recently, we fabricated a test magnet with six pancake coils, each containing three 10-m lengths of rolled tapes and tested at 4.2, 27, and 77 K as a function of applied fields up to 14.5 T. A maximum generated field of 1.25 T was measured in zero applied field at 4.2 T. Detailed measurements made on the pancake coils and test magnets are reported in this paper.

34487 (ANL/ET/CP–80302) **Fabrication and characteristics of a test magnet from HTS Bi-2223 silver-clad tapes.** Haldar, P. (Intermagnetics General Corp., Guilderland, NY (United States)); Hoehn, J.G. Jr.; Motowidlo, L.R.; Balachandran, U.; Iwasa, Y. Argonne National Lab., IL (United States). Jul 1993. 12p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930703–19: International cryogenic engineering conference and international cryogenic materials conference, Albuquerque, NM (United States), 12-16 Jul 1993). Order Number DE93018624. Source: OSTI; NTIS; GPO Dep.

Critical currents of powder-in-tube processed silver-clad Bi-2223 short tape samples and coils have been measured at liquid nitrogen (77 K), liquid neon (27 K) and liquid helium (4.2 K) temperatures. The short samples have been characterized in fields up to 20 T and indicate a large anisotropy at 27 K with resistive behavior above 15 T in the worst field direction. A test magnet consisting of pancake coils generated magnetic fields greater than 1.0, 0.7 and 0.11 T at 4.2 K, 27 K and 77 K respectively. The ctest magnet generates significant self-fields in background fields up to

14.5 T at 4.2 K and 27 K. Optimization of thermo-mechanical process parameters have yielded J_c's in the superconducting core > 4.0×10^4 A/cm^2 at 77 K, zero field and > 2.0×10^5 A/cm^2 at 4.2 K, zero field for short tape samples. Long lengths (>30 m) of silver-clad tape superconductors have also been fabricated and tested to carry significant amounts of current (J_c core > 10,000 A/cm^2) at 77 K. Overall J_c of short and long samples and characteristics of the test magnet are reported.

34488 (DOE/ER/40150–214) **Solvents and pumpdown characteristics of SRF Nb cavities.** Rao, M.G.; Kneisel, P.; Dylla, H.F. Southeastern Universities Research Association, Inc., Newport News, VA (United States). Continuous Electron Beam Accelerator Facility. Jun 1993. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84ER40150. (CEBAF-PR–93-020;CONF-930511–261: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93017510. Source: OSTI; NTIS; INIS; GPO Dep.

High-performance superconducting radio frequency (SRF) cavities are placed under UHV and low particulate conditions when they go through the surface treatment process, and are kept under these conditions permanently thereafter, both before and during use in the accelerator. The outgassing of the gasket material in the gate valves and the outgassing of the gasket material in the gate valves and the outgassing of the solvents that come in contact with the gasket and the cavity surfaces determine the ultimate pressure that can be obtained in the cavity. A systematic study of gaskets and various solvents was undertaken in order to understand the conditions that lead to a low ultimate pressure in a short period of time. Results with Kalrez, Vito O-rings and solvents like methanol, acetone, isopropyl and freon are presented in this paper. Also, we discuss the effect of a slow or fast initial pumpdown in order to prevent the settlement of particulates due to condensation.

34489 (DOE/FTR–93011426) **[Travel to Japan to participate in the International Superconducting Symposium]: Foreign trip report, November 6–25, 1992.** Howell, R.H. Lawrence Livermore National Lab., CA (United States). 10 Dec 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93011426. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report will describe the activities at the International Superconducting Symposium, ISS'92. ISS'92 contained in its scope the fabrication, and analysis of superconducting materials and their applications. It is next in a series of meetings held in Japan, sponsored by ISTEC, a Japanese organization dedicated to basic and precompetitive research in superconductivity. The meeting is international in scope but is heavily attended by the Japanese and along with ISTEC activities gives an overview of the state of Japanese basic and industrial research in superconductivity. Also described are visits by the traveler to Japanese ISTEC and other laboratories and universities conducting superconducting or materials research.

34490 (INIS-mf–13548, pp. 154-157) **Superconductors with voids superlattice.** Rud'ko, V.N. (AN Ukrainskoj SSR, Kiev (Ukraine). Inst. Yadernykh Issledovanij); Sugakov, V.I.; Shevtsova, O.N. AN Ukrainskoj SSR, Kharkov (Ukraine). Fiziko-Tekhnicheskij Inst. 1990. (In Russian). (CONF-9005247–: International conference on radiation material science, Alushta (USSR), 22-25 May 1990). In *Radiation materials science. V. 9.* 225p. Order Number DE94600002. Source: OSTI; NTIS (US Sales Only); INIS.

Superconductors with pore superlattice or with inclusion of another phase in magnetic fields were investigated. The dependence of third critical field H_{c3} on pore dimensions was found; diamagnetic properties of a system and current states of superconducting condensate were studied. At $H \leq H_{c2}$ parameters of vortex lattice depending on magnetic field and superlattice parameters were found and dependence of critical current on magnetic field value direction was investigated. 4 refs.; 2 figs. (author).

34491 (INIS-RU–347, pp. 424) **HTS oxygen index measuring on cyclotron beams.** Zhetbaev, A.K. (AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki); Vereshchak, M.F.; Kondrat'ev, N.A.; Kuterbekov, K.A.; Mukanov, A.K.; Pavlova, N.N.; Yushkov, A.V. AN SSSR, Moscow (Russian Federation); AN Kazakhskoj SSR, Alma-Ata (Kazakhstan). Inst. Yadernoj Fiziki. 1992. (In Russian). (CONF-9204253–: International conference on nuclear spectroscopy and nuclear structure, Alma-Ata (Kazakhstan), 21-24 Apr 1992). In *Nuclear spectroscopy and nuclear structure: Summary of reports for International conference.* 486p. Order Number DE94600001. Source: OSTI; NTIS (US Sales Only); INIS.

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Short communication. 2 refs., 1 fig., 1 tab. HIGH-TC SUPERCONDUCTORS/diagnostic techniques; HIGH-TC SUPERCONDUCTORS/elastic scattering; ALPHA PARTICLES; BARIUM COMPOUNDS; CERAMICS; CUPRATES; ENERGY DEPENDENCE; LANTHANUM COMPOUNDS; MEV RANGE 10-100; PROTON BEAMS; SPECTRA; STRONTIUM COMPOUNDS; SUPERCONDUCTIVITY; YTTRIUM COMPOUNDS

34492 (ORNL/FTR–4582) **Participation in the international symposium on high-$T_c$superconductivity and its applications (ISHTCS) held in Cairo, Egypt: Foreign trip report, April 3–18, 1993.** Wood, R.F. Oak Ridge National Lab., TN (United States). 3 May 1993. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93013712. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The traveler was invited to attend the ISHTCS in Cairo and to give a series of three lectures on his spin-polaron theory of high-$T_c$superconductivity and one lecture on superconducting superlattices. In addition, two days were spent at Ain Shams University where discussions with the faculty were held and another lecture on laser ablation and superconducting superlattices was given. The traveler also served on an ad hoc studying the feasibility of establishing a "national laboratory" for high-$T_c$superconductivity.

34493 Method and apparatus for dissipating remanent fields and preserving diamagnetism of ceramic superconductors. Youngdahl, C.A. To Dept. of Energy. 1991. USA patent application 7-728,477. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93019340. Source: OSTI; NTIS; GPO Dep.

A method for dissipating a remanent field, created when a magnetic field is brought into contact with a superconductor, comprising the steps of (1) providing a ceramic superconductor; (2) continuously or intermittently applying an AC current to the ceramic superconductor; (3) gradually removing the AC current until the undesired remanent field is dissipated.

6655 Direct Energy Conversion

Refer also to citation(s) 34646

70 PLASMA PHYSICS AND FUSION

Refer also to citation(s) 33457

34494 (ETDE-IT–93-203) **Evaluation of some low activation structural materials for minimizing radioactive waste production by future nuclear fusion power plants.** Donato, A. (Associazione EURATOM-ENEA sulla Fusione, Frascati (Italy)). 1993. 6p. (CONF-921101–138: 16. Materials Research Society fall meeting, Boston, MA (United States), 30 Nov - 5 dec 1992). Order Number DE93522953. Source: OSTI; NTIS (US Sales Only).

Taking into account neutron activation (Bq/kWht) and environmental impact in terms of Ingestion Toxic Potential (IT, cu. m H_2O-kWht) of radioactive wastes coming from several low activation structural material candidates for future nuclear fusion power reactors, the contribution of the material chemical composition elements and impurities, to overall radioactivity and IT, was assessed. The chemical impurities, also at very low concentrations, were ascertained to give in many cases a considerable contribution to the radioactive wastes environmental impact, as in the case of SiC/SiC fiber composites materials or low activation martensitic steels. Impurities origin was identified. Efforts to ameliorate the material production processes for nuclear fusion application are suggested.

7003 Plasma Physics and Fusion Research

Refer also to citation(s) 33730, 34604, 34609, 34610, 34617, 34624

34495 (CONF-931115–6) **Multi-CPU plasma fluid turbulence calculations on a CRAY Y-MP C90.** Lynch, V.E. (Oak Ridge National Lab., TN (United States)); Carreras, B.A.; Leboeuf, J.N.; Curtis, B.C.; Troutman, R.L. Oak Ridge National Lab., TN (United States). [1993]. 32p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Supercomputing conference on high performance computing and communications; Portland, OR (United States); 15-19 Nov 1993. Order Number DE93015425. Source: OSTI; NTIS; INIS; GPO Dep.

Significant improvements in real-time efficiency have been obtained for plasma fluid turbulence calculations by microtasking the nonlinear fluid code KITE in which they are implemented on the CRAY Y-MP C90 at the National Energy Research Supercomputer Center (NERSC). The number of processors accessed concurrently scales linearly with problem size. Close to six concurrent processors have so far been obtained with a three-dimensional nonlinear production calculation at the currently allowed memory size of 80 Mword. With a calculation size corresponding to the maximum allowed memory of 200 Mword in the next system configuration, we expect to be able to access close to nine processors of the C90 concurrently with a commensurate improvement in real-time efficiency. These improvements in performance are comparable to those expected from a massively parallel implementation of the same calculations on the Intel Paragon.

34496 (CTH-ED–146-L) **Impurity effects on toroidal ITG-modes and transport in tokamaks.** Froejdh, M. Chalmers Univ. of Technology, Goeteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics. Apr 1993. 29p. Order Number DE94600467. Source: OSTI; NTIS; INIS.

The presence of impurities in tokamak plasmas has until recently been ignored in several fluctuation driven transport models. In this thesis some of the consequences of including an ion impurity species into a model for low frequency electrostatic modes and fluctuation driven transport are discussed. The direction of the particle flows in a two-ion-component plasma is studied for the outer part of the good confinement region. When the two ion species, main and impurity ions, have similar inwardly peaked density profiles the latter tends to determine the flow directions for typical tokamak plasma conditions. Hence, the impurities flow outwards and the main ions inwards, leading to so called plasma decontamination. The stability of the toroidal main and impurity ion temperature gradient modes (ITG-modes) is determined by using an advanced fluid model. The impurity effect on the background mode is found to be stabilizing for a large domain of parameters. However, a destabilization is also possible. An impurity mode driven by toroidicity is found and shown to be unstable in a new parameter region. The particle and thermal diffusivities are estimated and the scaling properties are studied. The magnitude of the ion thermal conductivity is shown to decrease due to the stabilizing influence of impurities. The radial variation of the transport coefficients are considered for some experimental equilibrium profiles. The stability properties of a contaminated tokamak plasma with dissipative trapped electrons are investigated. The dissipation is found to change the instability thresholds. The relation between wave energy, electron dissipation and instability is discussed. (35 refs.).

34497 (CTH-IEFT-PP–1992-29) **Transport due to ion temperature gradient driven magnetic drift modes.** Heikkilae, A.; Weiland, J. Chalmers Univ. of Technology, Goeteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics. [1992]. 43p. Order Number DE94600434. Source: OSTI; NTIS; INIS.

An advanced reactive fluid model is used to study the transport due to the toroidal η_i mode in the flat density limit. In this limit the density gradient scale length scales out from both the linear dispersion relation and the quasi-linear transport coefficients. Simplified transport coefficients are derived for the flat density limit including also influence of electron trapping. The scaling properties with respect to various dimensionless parameters are discussed. In particular the scaling $\chi_i \approx \eta_i - \eta_{i_{th}}$, which has also been derived by other authors for somewhat different situations, is found to be the relevant scaling in typical situations. A stabilizing and transport reducing effect of a high degree of electron trapping is pointed out. (authors) (33 refs.).

34498 (CTH-IEFT-PP–1993-01) **Reactive drift wave model for Tokamak transport.** Nordman, H.; Weiland, J. Chalmers Univ. of Technology, Goeteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics. [1993]. 13p. Order Number DE94600468. Source: OSTI; NTIS; INIS.

Transport due to toroidal η_i and collisionless trapped electron modes is studied using an advanced reactive fluid model. Transport code simulation of DIII-D and JET discharges are analyzed. The recent experimental results with off axis electron cyclotron heating in the DIII-D tokamak are recovered with inward flow of electron energy and peaked electron temperature profile. For the JET equilibria the model give heat diffusivities of the correct order of magnitude which grow with radius up to r/a = 0.8. (authors) (22 refs.).

34499 (DOE/ER/53291–4) **Theoretical studies of turbulence and anomalous transport in toroidal confinement devices.** Terry, P.W. Wisconsin Univ., Madison, WI (United States). Dept. of Physics. [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-89ER53291. Order Number DE93040684. Source: OSTI; NTIS; INIS; GPO Dep.

The research performed under this grant has focused on key issues with respect to turbulence and transport in toroidal confinement devices. Progress and publications in these areas are summarized in this report. This work includes analytical and numerical studies of spectral energy transfer and the saturation dynamics and transport of dissipative and collisionless trapped electron turbulence, the role of flow curvature in L-H mode transition physics, fully nonlinear calculations of the anomalous particle transport from the ion mixing mode, and the development of a theory for the drift wave frequency spectrum. Novel aspects of this work include an elucidation of the role of nonlinear frequency shifts in producing nonstationary saturated states, an identification of reverse and non-conserved flows in Hasegawa-Mima turbulence, and a description of the way incoherent emission affects the frequency of turbulent fluctuations.

34500 (DOE/ER/54089–2) **Advanced fusion diagnostics: Final technical report, July 15, 1991–July 14, 1993.** Moses, K.G. Fusion Physics and Technology, Torrance, CA (United States). 14 Jul 1993. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG03-90ER54089. Order Number DE93040085. Source: OSTI; NTIS; INIS; GPO Dep.

Key among various issues of ignited plasmas is understanding the physics of energy transfer between thermal plasma particles and magnetically confined, highly energetic charged ions in a tokamak device. The superthermal particles are products of fusion reactions. The efficiency of energy transfer by collisions, from charged fusion products (e.g., α-particles) to plasma ions, grossly determines whether or not plasma conditions are self-sustaining without recourse to auxiliary heating. Furthermore, should energy transfer (efficiency be poor, and substantial auxiliary heating power is required to maintain reacting conditions within the plasma, economics may preclude commercial viability of fusion reactors. The required charged fusion product information is contained in the energy distribution function of these particles. Knowledge of temporal variations of the superthermal particle energy distribution function could be used by a fusion reactor control system to balance plasma conditions between thermal runaway and a modicum of fusion product energy transfer. Therefore, diagnostics providing data on the dynamical transfer of alpha-particle and other charged fusion product energy to the plasma ions are essential elements for a fusion reactor control system to insure that proper plasma conditions are maintained. The objective of this work is to assess if spectral analysis of rf radiation emitted by charged fusion products confined in a magnetized plasma, called ion cyclotron emission (ICE), can reveal the vital data of the distribution function of the superthermal particles.

34501 (DOE/ET/51013–T248) **The development of an Omegatron plasma ion mass spectrometer for Alcator C-Mod.** Thomas, E.E. Jr. Massachusetts Inst. of Tech., Cambridge, MA (United States). Plasma Fusion Center. May 1993. 117p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-78ET51013. (PFC/RR–93-3). Order Number DE93017617. Source: OSTI; NTIS; INIS; GPO Dep.

A new diagnostic device, the Omegatron Probe, has been developed to investigate relative impurity levels and impurity charge state distribution in the Alcator C-Mod Tokamak edge plasma. The Omegatron probe consists of two principal components, a "front-end" of independently biased grids, arranged in a gridded energy analyzer fashion and a large collection cavity. Particles enter the probe in a thin "ribbon" through a knife-edge slit. The grids provide a means to measure and control the parallel energy distribution of the ions. In the collection cavity, an oscillating electric field is applied perpendicularly to the ambient magnetic field. Ions whose cyclotron frequencies are resonant with this electric field oscillation will gain perpendicular energy and be collected. In this way, the probe can be operated in two modes: first, by fixing the potentials on the grids and sweeping frequencies to obtain a " Z/m spectrum" of ion species and second, by fixing the frequency and sweeping the grid potentials to obtain the distribution function of an individual impurity species. The Omegatron probe performed successfully in tests on a Hollow Cathode Discharge (HCD) linear plasma column. It obtained measurements of $T_e \approx 5$ eV, T_i (H^+) $\approx 2.0 \pm 0.2$ eV, $n_0 \approx 9 \times 10^{15}$ m^{-3}, RMS potential fluctuation levels of $\sim 0.5 \pm 0.05 \pm T_e$, and obtained "Z/m" spectra for the plasma ions (H^+, H_2^+, He^+). Additional experiments confirmed the theoretical scalings of the $f/\delta f$ resolution with the applied electric field and magnetic field strengths. The instrument yielded an absolute level of resolution, $f/\delta f$, of approximately 2.5 to 3 times the theoretical values. Finally, the results from the HCD are used to project operation on Alcator C-Mod.

34502 (DOE/ET/53088–546) **On neutral plasma oscillations.** Shadwick, B.A.; Morrison, P.J. Texas Univ., Austin, TX (United States). Inst. for Fusion Studies. Jun 1993. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-80ET53088. (IFSR–546). Order Number DE93040319. Source: OSTI; NTIS; INIS; GPO Dep.

We examine the conditions for the existence of spectrally stable neutral modes in a Vlasov-Poisson plasma and show that for stable equilibria of systems that have unbounded spatial domain, the only possible neutral modes are those with phase velocities that correspond to stationary inflection points of the equilibrium distribution function. It is seen that these neutral modes can possess positive or negative free energy.

34503 (DOE/ET/53088–609) **Ion mobility and transport barriers in the tokamak plasmas.** Xiao, H. (Texas Univ., Austin, TX (United States). Inst. for Fusion Studies); Hazeltine, R.D.; Valanju, P.M.; Zhang, Y.Z. Texas Univ., Austin, TX (United States). Inst. for Fusion Studies. Jun 1993. 13p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-80ET53088. (IFSR–609). Order Number DE93040320. Source: OSTI; NTIS; INIS; GPO Dep.

The character of charged particle motion in an axisymmetric toroidal system with a constant radial electric field is investigated both analytically and numerically. Ion radial mobility caused by the combined effects of the radial electric field and charge exchange is found. A simple moment argument in the banana regime matches the simulation results well. Relation of present work and high confinement (H-mode) experiment is also discussed.

34504 (DOE/ET/53088–616) **Finite beta plasma equilibrium in toroidally linked mirrors.** Ilgisonis, V.I.; Berk, H.L.; Pastukhov, V.P. Texas Univ., Austin, TX (United States). Inst. for Fusion Studies. Jul 1993. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-80ET53088. (IFSR–616). Order Number DE93040318. Source: OSTI; NTIS; INIS; GPO Dep.

The problem of finite pressure plasma equilibrium in a system with closed magnetic field lines consisting of quadrupole mirrors linked by simple toroidal cells with elliptical cross-sections is analyzed. An appropriate analytical procedure is developed, that uses conformal mapping techniques, which enables one to obtain the magnetic field structure for the free boundary equilibrium problem. This method has general applicability for finding analytic solutions of the two-dimensional Dirichlet problem outside of an arbitrary closed contour. Using this method, the deformations of the plasma equilibrium configuration due to finite plasma pressure in the toroidal cell are calculated analytically to the second order in λ-expansion, where $\lambda \sim \beta/\epsilon E$, β is the ratio of plasma pressure to the magnetic field pressure, ϵ is the inverse aspect ratio and E is the ellipticity of the plasma cross-section. The outer displacement of the plasma column is shown to depend nonlinearly on the increase of plasma pressure, and does not prevent the achievement of substantial $\beta \sim 10\%$ in the toroidal cells.

34505 (ENEA-RTI-INN–92-16) **Magnetohydrodynamic equilibria and poloidal field systems for IGNITOR-ULT.** Cenacchi, G. (ENEA, Bologna (Italy). Centro Ricerche Energia 'E. Clementel' - Area Energia e Innovazione); Coppi, B.; Lanzavecchia, L. Nov 1992. 42p. (RTI-INN–92-16). Order Number DE93522950. Source: OSTI; NTIS (US Sales Only).

The ideal magneto-hydro-dynamic (MHD) equilibrium configurations of the plasma column and the relevant poloidal field system appropriate for an advanced compact ignition experiment (IGNITOR-ULT) were analyzed. The plasma geometry evolution during the current pulse and proper series of MHD equilibria referring to the most advanced operating regime proposed were envisaged. The plasma start-up phase was also investigated. Current values to be fed into the poloidal field windings were derived for producing a set of optimal plasma confinement configurations. In the machine design adopted, the air-core transformer and the equilibrium field coils are combined into a convenient set of windings that reduces the overall current requirements, while preserving the ability to induce the desired plasma currents, and the equipment can be accomodated within the supporting structure of the machine. The results obtained show that the proposed PFC system can produce and maintain the designed plasma equilibrium configurations over a wide range of plasma parameters, with good safety margins against macroscopic instabilities.

34506 (GTFR–108) **Viscosity in the edge of tokamak plasmas.** Stacey, W.M. Georgia Inst. of Tech., Atlanta, GA (United States). May 1993. 35p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG05-87ER52141. Order Number DE93018039. Source: OSTI; NTIS; INIS; GPO Dep.

A fluid representation of viscosity has been incorporated into a set of fluid equations that are maximally ordered in the "short-radial-gradient-scale-length" (srgsl) ordering that is appropriate for the edge of tokamak plasmas. The srgsl ordering raises viscous drifts and other viscous terms to leading order and fundamentally alters the character of the fluid equations. A leasing order viscous drift is identified. Viscous-driven radial particle and energy fluxes in the scrape-off layer and divertor channel are estimated to have an order unity effect in reducing radial peaking of energy fluxes transported along the field lines to divertor collector plates.

34507 (INIS-RU–352, pp. 9-11) **Increase of electromagnetic radiation frequency in interaction with nonlinear plasma waves.** Bulanov, S.V. (AN SSSR, Moscow (Russian Federation). Inst. Obshchej Fiziki); Kirsanov, V.I.; Naumova, N.M.; Sakharov, A.S.; Inovenkov, I.N. AN SSSR, Moscow (Russian Federation). Fizicheskij Inst. 1991. (In Russian). In *Short communications on physics. Experimental and theoretical physics. No. 6.* 42p. Order Number DE94600073. Source: OSTI; NTIS (US Sales Only); INIS.

Interaction of electromagnetic radiation with nonlinear plasma waves (NPW) was studied. It is shown that the noticeable reflection is realized on sharp electron concentration jumps in reversing NPW, for which electron maximum velocity is equal to or greater than the phase velocity of relativistic plasma waves. The interaction with one of jumps is considered, as the reversing takes place not simultaneously in all maxima, when the wake waves are excited. When NPW are excited by a short pulse of high-power laser radiation with carrier frequency $\omega_0 > \omega_1 >> \omega_p$ (where ω_1 is the incident wave frequency and ω_p is the Langmuir frequency), the reflected wave intensity increases approximately as the ratio $(\omega_0/\omega_1)^{8/3}$. The conclusion is made that the frequency increase can be accompanied by sufficiently efficient energy conversion, when electromagnetic radiation is reflected on fast Langmuir wave close to reversing.

34508 (INIS-RU–352, pp. 38-41) **On the theory of electron distribution during cyclotron absorption of electromagnetic field in plasma.** Novikov, V.N.; Ovchinnikov, K.N.; Silin, V.P.; Uryupin, S.A. AN SSSR, Moscow (Russian Federation). Fizicheskij

Inst. 1991. (In Russian). In *Short communications on physics. Experimental and theoretical physics. No. 6.* 42p. Order Number DE94600073. Source: OSTI; NTIS (US Sales Only); INIS.

The evolution of electron distribution in completely ionized plasma located in constant homogeneous magnetic field and circular polarized hf electric field, was studied. The solution was realized with account for electron-electron collisions and for frequency nonequal to the cyclotron resonance one. The equation describing time variations of the electron thermal motion energy, was derived. The equation was solved numerically. The dependences of the electron distribution evolution and absorbed power on parameter α characterizing the hf field intensity, were obtained for the field frequencies close to the electron cyclotron one. As α grows the degree of the distribution function deviation from the Maxwell curve increases and heating rate grows as well, which leads to distribution transformation into the Maxwell one.

34509 (IRF–211) **Phase-space description of plasma waves. Linear and nonlinear theory.** Biro, T. (Swedish Inst. of Space Physics, Umeaa Univ. (Sweden)). Swedish Inst. of Space Physics, Kiruna (Sweden). Nov 1992. 10p. Order Number DE94600492. Source: OSTI; NTIS; INIS.

We develop an (r,k) phase space description of waves in plasmas by introducing Gaussian window functions to separate short scale oscillations from long scale modulations of the wave fields and variations in the plasma parameters. To obtain a wave equation that unambiguously separates conservative dynamics from dissipation also in an inhomogeneous and time varying background plasma, we first discuss the proper form of the current response function. On the analogy of the particle distribution function f(v,r,t), we introduce a wave density N(k,r,t) on phase space. This function is proven to satisfy a simple continuity equation. Dissipation is also included, and this allows us to describe the damping or growth of wave density' along rays. Problems involving geometric optics of continuous media often appear simpler when viewed in phase space, since the flow of N in phase space is incompressible. Within the phase space representation, we obtain a very general formula for the second order nonlinear current in terms of the vector potential. This formula is a convenient starting point for studies of coherent as well as turbulent nonlinear processes. We derive kinetic equations for weakly inhomogeneous and turbulent plasma, including the effects of inhomogeneous turbulence, wave convection and refraction. (author).

34510 (KFKI–1992-29/D) **Modeling the cathode region of noble gas mixture discharges using Monte Carlo simulation.** Donko, Z.; Janossy, M. Hungarian Academy of Sciences, Budapest (Hungary). Central Research Inst. for Physics. Oct 1992. 39p. Order Number DE94600527. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Journal of Physics D: Applied Physics.

A model of the cathode dark space of DC glow discharges was developed in order to study the effects caused by mixing small amounts ($\leq$2%) of other noble gases (Ne, Ar, Kr and Xe) to He. The motion of charged particles was described by Monte Carlo simulation. Several discharge parameters (electron and ion energy distribution functions, electron and ion current densities, reduced ionization coefficients, and current density-voltage characteristics) were obtained. Small amounts of admixtures were found to modify significantly the discharge parameters. Current density-voltage characteristics obtained from the model showed good agreement with experimental data. (author) 40 refs.; 14 figs.

34511 (LA-UR–93-2769) **Facility for intense diagnostic neutral beam (IDNB) development.** Kasik, R.J.; Hinckley, W.B.; Bartsch, R.R.; Rej, D.J.; Henins, I.; Greenly, J.B. Los Alamos National Lab., NM (United States). [1993]. 4p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930616–15: 9. IEEE pulsed power conference, Albuquerque, NM (United States), 21-23 Jun 1993). Order Number DE93018288. Source: OSTI; NTIS; INIS; GPO Dep.

An intense, pulsed neutral beam source is under development for use as a probe beam on hot, burning plasmas such as in the international thermonuclear experimental reactor (ITER) which is presently in the planning stage. A pulsed, neutral hydrogen beam of 10s of kilo amperes of current can have an alpha particle, charge-exchange-recombination-spectroscopy (alpha-CHERS) signal-to-noise ratio of $\sim$ 10. This beam would allow the measurement, on a single pulse of a few hundred nanoseconds duration, of the local alpha particle distribution function as well as other features of the tokamak plasma such as current density profile, impurity density, and microturbulence spectrum. The cross-sections for the CHERS diagnostic dictate operation with proton energies greater than ~50keV. A pulsed neutral hydrogen source of this voltage and intensity can be achieved by neutralizing the ion flux from a magnetized ion-diode. The cross-sections for attachment and stripping, when coupled with scaling from Child-Langmiur, space-charge-limited, ion-current flow imply operation below ~ 100keV for maximum neutral fluence. The development of a flashover-anode, ion source for forthcoming evaluation of a neutralizing section is described below. This source operates in the accelerator voltage range 70 to 100keV. Eventually, the flashover-anode, magnetized ion-diode will be replaced with a plasma-anode, magnetized ion-diode.

34512 (NIFS–205) **A compact neutron counter telescope with thick radiator (COTETRA) for fusion experiment.** Osakabe, M. (The Graduate Univ. for Advanced Studies, Nagoya (Japan)); Itoh, S.; Gotoh, Y.; Sasao, M.; Fujita, J. National Inst. for Fusion Science, Nagoya (Japan). Jan 1993. 33p. Order Number DE93520241. Source: OSTI; NTIS; INIS.

A new type of neutron spectrometer, based on recoil proton measurement, has been developed for diagnosing a DT fusion plasma. This spectrometer has such advantages as: 1. direct measurement of the neutron energy without the unfolding procedure, 2. relatively high detection efficiency for 14 MeV neutrons, 3. a wide dynamic range of counting rate, and 4. perfect n-γ discrimination. To examine the performance of this spectrometer, we developed a Monte Carlo simulation code. It predicts that we may achieve energy resolution up to 3 % with a detection efficiency of 10^{-5} [count cm^2/n] if we could successfully adjust the condition of the spectrometer. A prototype spectrometer was constructed and was compared with the Monte Carlo prediction. The energy resolution of 5.3 $\pm$ 0.7 % for 14 MeV neutron was obtained for the prototype spectrometer and the calculation agrees with the experimental results within its margin of error if we take into account the intrinsic energy resolution of the detector that is used in the prototype. (author).

34513 (PPPL–2925) **Control of the current density profile with lower hybrid current drive on PBX-M.** Bell, R.E. (Princeton Univ., NJ (United States). Plasma Physics Lab.); Bernabei, S.; Chu, T.K.; Gettelfinger, G.; Greenough, N.; Hatcher, R.; Ignat, D.; Jardin, S.; Kaita, R.; Kaye, S.; Kozub, T.; Kugel, H.; LeBlanc, B.; Okabayashi, M.; Paul, S.; Sauthoff,Princeton Univ., NJ (United States). Plasma Physics Lab. Jul 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03073. (CONF-9304112–20: 10. topical conference on radio frequency power in plasmas, Boston, MA (United States), 1-3 Apr 1993). Order Number DE93017518. Source: OSTI; NTIS; INIS; GPO Dep.

Lower hybrid current drive (LHCD) is being explored as a means to control the current density profile on PBX-M with the goal of raising the central safety factor q(O) to values of 1.5-2 to facilitate access to a full-volume second stable regime. Initial experiments have been conducted with up to 400 kW of 4.6 GHz LH power in circular and indented plasmas with modest parameters. A tangential-viewing two-dimensional hard x-ray imaging diagnostic has been used to observe the bremsstrahlung emission from the suprathermal electrons generated during LHCD. Hollow hard x-ray images have indicated off-axis localization of the driven current. A serious obstacle to the control of the current density profile with LHCD is the concomitant generation of MHD activity, which can seriously degrade the confinement of suprathermal electrons. By combining neutral beam injection with LHCD, an MHD-free condition has been obtained where q(O) is raised above 1.

34514 (SAND–93-0425C) **Application of piezoelectric stress gauges to the measurement of fast-rise-time multimegampere electric currents.** Hanson, D.L. (Sandia National Labs., Albuquerque, NM (United States)); Spielman, R.B.; Seamen, J.F.; Struve, K.W. Sandia National Labs., Albuquerque, NM (United States). [1993]. 20p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United

States). DOE Contract AC04-76DP00789. (CONF-930676–3: 14. international conference of the International Association for the Advancement of High Pressure Science and Technology, Colorado Springs, CO (United States), 27 Jun - 2 jul 1993). Order Number DE93017625. Source: OSTI; NTIS; GPO Dep.

Modeling of load behavior in Z-pinch plasma radiation sources driven by high current generators requires accurate measurement of fast-rise-time multimegampere electrical currents close to the load. Using a novel application of high pressure technology, we have demonstrated that fast-response piezoelectric stress transducers can measure such currents under conditions of extremely high current density, induced electric fields, and bremsstrahlung radiation where conventional current diagnostics fail. Large signal, nanosecond-time-resolution lithium niobate piezoelectric stress gauges are employed to directly measure the magnetic pressure $B^2/2\mu_0 = \mu_0 I^2/8\pi^2 r^2$ generated at radius r by a current I flowing in a radial transmission line near the load of a pulsed power current source. With a current diagnostic consisting of a pure tungsten electrode on a Y-cut lithium niobate stress gauge, current densities up to $1/2\pi cr$ = 78MA/m can be measured before the electrode yield strength and piezoelectric operating stress limit are exceeded. Based on this work, we have developed a compact modular current probe for use on the high current (20–25 MA) DECADE simulator being constructed for the Defense Nuclear Agency. We also describe recent work extending this measurement technique to higher current densities (125 MA/m) using a cooper-sapphire electrode impedance stack on an X-cut quartz piezoelectric element.

34515 (TRITA-ALF–92-07) **Determination of toroidal equilibrium parameters from magnetic probe measurements.** Brynolf, J. (Uppsala Univ. (Sweden). Dept. of Technology); Eriksson, H.G.; Persson, H.; Hellblom, G. Royal Inst. of Tech., Stockholm (Sweden). Dept. of Fusion Plasma Physics. Dec 1992. 30p. Order Number DE94600437. Source: OSTI; NTIS; INIS.

A method has been developed by which the poloidal flux function in the vacuum region between the plasma and the external conductors (and the iron core) can be deduced from external magnetic field measurements. The plasma is in equilibrium and the solution is restricted to plasmas without irregularities. The poloidal field components $B\theta$ and B_r are measured at different poloidal positions outside the liner and modelled by truncated Fourier series. The Grad-Shafranov equation in the vacuum region is then solved with these modelled values of $B\theta$ and B_r as boundary conditions. (authors).

34516 (TRITA-ALF–92-08) **An elegant method to estimate helium-like ion densities from visible plasma spectroscopy.** Zastrov, K.D. (Royal Inst. of Tech., Stockholm (Sweden). Dept. of Physics); Hoerling, P.; Rachlew-Kaellne, E.; Brzozowski, J.H. Royal Inst. of Tech., Stockholm (Sweden). Dept. of Fusion Plasma Physics. Dec 1992. 15p. Order Number DE94600464. Source: OSTI; NTIS; INIS.

A method is presented to estimate time resolved densities of He-like carbon and oxygen ions from the observation of Li-like $1s^2 3p \rightarrow 1s^2 3s$ transitions based on a 0-dimensional model for plasmas with short particle confinement times. General coefficients for this study are derived. The method is applied to Extrap-T1 RFP data. (authors).

34517 (TRITA-ALF–92-09) **Soft X-ray diagnostic at the EXTRAP-T1 experiment.** Voronin, A. (A.F. Ioffe Physico-Technical Institute, St. Petersburg (Russian Federation)); Welander, A. Royal Inst. of Tech., Stockholm (Sweden). Dept. of Fusion Plasma Physics. Dec 1992. 25p. Order Number DE94600465. Source: OSTI; NTIS; INIS.

Results of investigating the soft x-ray wavelength region of reversed field pinch (RFP) discharges at the EXTRAP-T1 device are presented. A non-dispersive technique based on the multiple-filters method has been developed to measure the electron temperature and plasma instabilities. Time resolved local temperature measurements of 100-300 eV near the torus axis were carried out. The electron temperature dependence on plasma current and conditions of the operation of the device has been experimentally established. (authors).

34518 (TRITA-ALF–92-10) **A two-filter soft x-ray spectrometer for plasma electron temperature measurement.** Voronin, A. (A.F. Ioffe Physico Technical Inst., St. Petersburg (Russian Federation)); Welander, A.; Drake, J.R. Royal Inst. of Tech., Stockholm (Sweden). Dept. of Fusion Plasma Physics. Dec 1992. 13p. Order Number DE94600466. Source: OSTI; NTIS; INIS.

The ratio of the intensity of continuum soft x-ray radiation in a selected wavelength region free from line radiation, measured by two different multiple-filter detectors, is used to estimate the electron temperature in a fusion plasma experiment. The detectors are silicon surface barrier diodes, each covered with different filters, selective for the same continuum interval but having different transmission dependencies on temperature. The ratio of the signal intensity is then temperature dependent but independent of plasma density. A criterion for the ratio method to be dependable is that the wave length region observed must be free from line radiation since the ratio of line radiation intensities would be dependent on species density as well as temperature. The wavelength region selected is 45-70 Aa which is free of oxygen and carbon line radiation, which are the dominant impurities in many fusion plasma experiments. The electron temperature range suitable for measurement is dependent on the filter parameters. Two cases have been developed which are suitable for temperature ranges of 50-150 eV and 100-300 eV. The electron temperature measurements are in good agreement with Thomson scattering measurements and measurements derived from line ratios in the vacuum ultraviolet wavelength region. (authors).

34519 (TRITA-ALF–92-11) **Reports from the Department of Fusion Plasma Physics: Index and abstracts 1992.** Royal Inst. of Tech., Stockholm (Sweden). Dept. of Fusion Plasma Physics. Mar 1993. 15p. Order Number DE94600435. Source: OSTI; NTIS; INIS.

Presents titles and abstracts of published reports in the research and training programme on controlled thermonuclear fusion and plasma physics (EUR-NFR).

34520 (UCRL-JC–109884) **Electron cyclotron resonance heating in the microwave tokamak experiment.** Allen, S.L. (and others); Casper, T.A.; Fenstermacher, M.E. Lawrence Livermore National Lab., CA (United States). Sep 1992. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-920913–32: 14. international conference on plasma physics and controlled nuclear fusion research, Wurzburg (Germany), 30 Sep - 7 oct 1992; IAEA-CN–56/E-1-4). Order Number DE93018083. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents the results from a series of Electron Cyclotron Resonance Heating (ECRH) experiments on the Microwave Tokamak Experiment (MTX). On-axis heating at B_T = 5T (f_{ce} = 140 GHz) has been performed at electron densities up to cutoff. We have used both a long-pulse gryotron (~200 kW, ~0.1s) and a pulsed Free Electron Laser (FEL) as microwave sources. Gyrotron experiments with power densities corresponding to 4 MW m^{-3}. A far infrared (FIR) polarimeter measured peaking of plasma current profiles in some discharges during the ECRH pulse. During high-power single-pulse FEL experiments, single-pass microwave transmission measurements show nonlinear effects; i.e., higher transmission than predicted by linear theory. A corrugated-wall duct was used in the tokamak port to increase the gradient of the parallel refractive index $n_{parallel}$ of the incident wave, and increased absorption was observed. Evidence of electron tail heating during FEL pulses was observed on soft x-ray and ECE diagnostics. These results are in agreement with predictions of nonlinear theory; extrapolation of this theory to reactor-like conditions indicates efficient absorption and heating. A Laser Assisted Particle Probe Spectroscopy (LAPPS) diagnostic provided estimates of the vacuum electric field of the FEL which were consistent with the measured power. Multiple pulse operation of the ETA-II accelerator for the FEL has also been demonstrated, indicating the feasibility of high-average power FEL operation.

34521 (UCRL-JC–113165) **Time-resolved probing of electron thermal conduction in femtosecond-laser-pulse-produced plasmas.** Vue, B.T.V. (Lawrence Livermore National Lab., CA (United States)); Szoke, A.; Landen, O.L. Lawrence Livermore National Lab., CA (United States). Jun 1993. 6p. Sponsored by

USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9304144–10: 2. international conference on laser ablation: mechanisms and applications, Knoxville, TN (United States), 19-22 Apr 1993). Order Number DE93016996. Source: OSTI; NTIS; INIS; GPO Dep.

We present time-resolved measurements of reflectivity, transmissivity and frequency shifts of probe light interacting with the rear of a disk-like plasma produced by irradiation of a transparent solid target with 0.1ps FWHM laser pulses at peak intensity 5×10^{14}W/CM^2. Experimental results show a large increase in reflection, revealing rapid formation of a steep gradient and overdense surface plasma layer during the first picosecond after irradiation. Frequency shifts due to a moving ionization created by thermal conduction into the solid target are recorded. Calculations using a nonlinear thermal heat wave model show good agreement with the measured frequency shifts, further confining the strong thermal transport effect.

34522 (UCRL-JC–113179) **Development of short pulse soft x-ray lasers.** Da Silva, L.B.; MacGowan, B.J.; Koch, J.A.; Mrowka, S.; Matthews, D.L.; Eder, D.; London, R. Lawrence Livermore National Lab., CA (United States). Feb 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930159–48: OE/LASE '93: International Society for Optical Engineering (SPIE) conference, Los Angeles, CA (United States), 16-23 Jan 1993). Order Number DE93017150. Source: OSTI; NTIS; GPO Dep.

X-ray lasers with pulse duration shorter than 20 ps allow the possibility of imaging laser produced plasmas with μm resolution. In addition, the high peak brightness of these new sources will allow us to study nonlinear optics in the xuv region. In this paper we will describe our efforts to produce collisionally pumped short pulse x-ray lasers. Initial results, which have produced ~ 45 ps (FWHM) x-ray lasers, using a double pulse irradiation technique are presented along with a discussion of the prospects for reducing the pulse width.

34523 (UCRL-JC–113264) **Lower hybrid counter current drive for edge current density modification in DIII-D.** Fenstermacher, M.E. (Lawrence Livermore National Lab., CA (US)); Nevins, W.M.; Porkolab, M.; Bonoli, P.T.; Harvey, R.W. Lawrence Livermore National Lab., CA (United States); General Atomics, San Diego, CA (United States). Jul 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48 ;AC03-89ER53277. (CONF-9304112–23: 10. topical conference on radio frequency power in plasmas, Boston, MA (United States), 1-3 Apr 1993). Order Number DE93019157. Source: OSTI; NTIS; INIS; GPO Dep.

Each of the Advanced Tokamak operating modes in DIII-D is thought to have a distinctive current density profile. So far these modes have only been achieved transiently through experiments which ramp the plasma current and shape. Extension of these modes to steady state requires non-inductive current profile control, e.g. with lower hybrid current drive (LHCD). Calculations of LHCD have been done for DIII-D using the ACCOME and CQL3D codes, showing that counter driven current at the plasma edge can cancel some of the undesirable edge bootstrap current and potentially extend the VH-mode. Results are presented for scenarios using 2.45 GHz LH waves launched from both the midplane and off-axis ports. The sensitivity of the results to injected power, n_e and T_e, and launched wave spectrum is also shown.

34524 (UCRL-JC–113265) **Experiments on nonlinear absorption of ECH waves in MTX and a comparison with theory.** Stallard, B.W. (Lawrence Livermore National Lab., CA (US)); Allen, S.L.; Byers, J.A.; Casper, T.A.; Cohen, B.I.; Cohen, R.H.; Lasnier, C.J.; Fenstermacher, M.E.; Foote, J.H.; Hooper, E.B.; Makowski, M.A.; Meyer, W.H.; Moller, J.M.; Rice, B.W.; Roglien, T.DLawrence Livermore National Lab., CA (United States). Jul 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9304112–22: 10. topical conference on radio frequency power in plasmas, Boston, MA (United States), 1-3 Apr 1993). Order Number DE93019158. Source: OSTI; NTIS; GPO Dep.

Intense pulse electron cyclotron heating (ECH) experiments have been carried out on the MTX tokamak. Rf pulses at 140 GHz, peak power of 1–2 GW, and 25 ns pulse length were generated by the ETA-II/IMP FEL and transported quasi-optically to MTX for o-mode launch. Because of the intense rf electric fields (~250 keV/cm), reduction of plasma absorption by nonlinear effects were expected and several rf beam geometries ($k_{||}$ gradient) were investigated to study their effect on the absorption. As predicted by theory, measurements of beam transmission showed increases compared to low power (2 kW). For these experiments x-ray, ECE, and Thomson diagnostics showed evidence for localized absorption at the cyclotron resonance and hot electron production. A comparison of these results with the orbit following code ORPAT is presented.

34525 (UCRL-LR–113062) **An experimental investigation of stimulated Brillouin scattering in laser-produced plasmas relevant to inertial confinement fusion.** Bradley, K.S. (Univ. of California, Davis, CA (US)). Lawrence Livermore National Lab., CA (United States). 11 Feb 1993. 206p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93018067. Source: OSTI; NTIS; INIS; GPO Dep.

Thesis submitted to University of California, Davis, CA (US).

Despite the apparent simplicity of controlled fusion, there are many phenomena which have prevented its achievement. One phenomenon is laser-plasma instabilities. An investigation of one such instability, stimulated Brillouin scattering (SBS), is reported here. SBS is a parametric process whereby an electromagnetic wave (the parent wave) decays into another electromagnetic wave and an ion acoustic wave (the daughter waves). SBS impedes controlled fusion since it can scatter much or all of the incident laser light, resulting in poor drive symmetry and inefficient laser-plasma coupling. It is widely believed that SBS becomes convectively unstable–that is, it grows as it traverses the plasma. Though it has yet to be definitively tested, convective theory is often invoked to explain experimental observations, even when one or more of the theory's assumptions are violated. In contrast, the experiments reported here not only obeyed the assumptions of the theory, but were also conducted in plasmas with peak densities well below quarter-critical density. This prevented other competing or coexisting phenomena from occurring, thereby providing clearly interpretable results. These are the first SBS experiments that were designed to be both a clear test of linear convective theory and pertinent to controlled fusion research. A crucial part of this series of experiments was the development of a new instrument, the Multiple Angle Time Resolving Spectrometer (MATRS). MATRS has the unique capability of both spectrally and temporally resolving absolute levels of scattered light at many angles simultaneously, and is the first of its kind used in laser-plasma experiments. A detailed comparison of the theoretical predictions and the experimental observations is made.

34526 (UCRL-LR–113984) **Behavior of the particle transport coefficients near the density limit in MTX.** Marinak, M.M. Lawrence Livermore National Lab., CA (United States). Apr 1993. 202p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93019108. Source: OSTI; NTIS; INIS; GPO Dep.

The perturbed particle transport coefficients were determined for a range of plasma conditions in the Alcator C tokamak, a component of the Microwave Tokamak Experiment (MTX), from analysis of density perturbations created in gas modulation experiments. Density measurements from a 15 chord far-infrared interferometer were sufficiently detailed to allow radial profiles of the transport coefficients to be resolved. Gas modulation experiments were carried out on plasmas over a range of relatively low currents and a wide variety of line-averaged densities, including values near the Greenwald density limit. With this technique the perturbed diffusion coefficient D and the perturbed convection velocity V can be determined simultaneously. Measured profiles of D rise toward the outside of the plasma column in a manner generally similar to those determined previously for $\chi_{e,HP}$ from sawtooth heat pulse propagation. Values of D are typically smaller than those of $\chi_{e,HP}$ given for the same line-averaged densities by a factor of 2-5. Diffusion coefficients from a series of discharges at constant current showed little variation with density through most of the saturated ohmic confinement regime. At the Greenwald density limit threshold a dramatic increase occurred in both the perturbed convective and diffusive transport coefficients in the outer region of the

plasma. The increases were most pronounced at the outermost range of the radii where coefficients were determined (r/a = 0.8), but were apparent over a region which extended well into the plasma interior. Density profiles maintained a similar shape near the density limit, congruous with the similar behavior of the transport coefficients. No dramatic deterioration was evident in the global energy confinement.

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Refer also to citation(s) 33158, 34020, 34505, 34520, 34523, 34525

34527 (ANL/EP/CP–78902) **Thermal analysis of coatings and substrate materials during a disruption in fusion reactors.** Hassanein, A. Argonne National Lab., IL (United States). Jun 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-930722–9: Annual meeting of the Society of Photo-Optical Instrumentation Engineers (SPIE), San Diego, CA (United States), 11-16 Jul 1993). Order Number DE93017688. Source: OSTI; NTIS; INIS; GPO Dep.

In a tokamak fusion reactor, the frequency of occurrence and the severity of a plasma disruption event will determine the lifetime of the plasma facing components. Disruptions are plasma instabilities which result in rapid loss of confinement and termination of plasma current Intense energy fluxes to components like the rust wall and the divertor plate are expected during the disruptions. This high energy deposition in short times may cause severe surface erosion of these components resulting from melting and vaporization. Coatings and tile materials are proposed to protect and maintain the integrity of the underneath, structural materials from both erosion losses as well as from high thermal stresses encountered during a disruption. The coating thickness should be large enough to withstand both erosion losses and to reduce the temperature rise in the substrate structural material. The coating thickness should be minimized to enhance the structural integrity, to reduce potential problems from radioactivity, and to minimize materials cost. Tile materials such as graphite and coating materials such as beryllium and tungsten on structural materials like copper, steel, and vanadium are analyzed and compared as potential diverter and first wall design options. The effect of the sprayed coating properties during the disruption is investigated. Porous sprayed material may be found to protect the structure better than condensed phase properties. The minimum coating thickness required to protect the structural material during disruption is discussed. The impact of self shielding effect by the eroded material oil the response of both the type/coating and the substrate is discussed.

34528 (BNL–52382) **A Draft Preconceptual design for a Spallation-Induced Lithium Conversion (SILC) target for the Accelerator Production of Tritium (APT).** Van Tuyle, G.J.; Cokinos, D.; Czajkowski, C.; Franz, E.; Kroeger, P.; Todosow, M.; Youngblood, R.; Zucker, M. Brookhaven National Lab., Upton, NY (United States). 22 Mar 1993. 67p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE93019776. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The draft preconceptual design of the APT Li-Al target system is summarized in this report. The system has been designed to produce a "3/8 Goal" quantity of tritium using the 200mA, 1.0-GeV proton beam emerging from the LANL-designed LINAC. The target system consists of a beam expander, a heavy-water-cooled lead spallation neutron source, a water-cooled Li-Al blanket, a target window, heat removal system, and related safety systems. Draft design descriptions are also provided for the target fabrication, tritium extraction, and waste-steam processes. Performance characteristics are presented and discussed.

34529 (CONF-930720–19) **The use of large surface area for particle and power deposition.** Seigneur, A. (Association Euratom-CEA, Centre d'Etude de Cadarache, 13 - Saint-Paul-lez-Durance (France)); Guihem, D.; Hogan, J.T. Oak Ridge National Lab., TN (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From 20. European conference on controlled fusion and plasma physics; Lisbon (Portugal); 26-30 Jul 1993. Order Number DE93018458. Source: OSTI; NTIS; INIS; GPO Dep.

Since the parallel heat flux passing through the LCFS has increased dramatically with the size of machines one has to cope with very large particle and power fluxes on the limiters. Thus the size of the limiters has been increased by the use of inner bumper limiters. The "exponential-sine" model is widely used to estimate the heat flux (Q) to a wall for a plasma flux surface with incident angle θ. The model predicts $Q = q_{||}(O) \sin\theta\, e^{-\rho/\lambda q} + q_{\perp}(O)\cos\theta e^{-\rho/\lambda q}$ ρ is the minor radius measured from the last closed flux surface (LCFS), λ_q is the SOL decay length of the heat, flux density and q(O) is the heat flux density at the last closed surface. If we approximate the heat flux as $Q = q_{||}\, e^{-\rho/\lambda q} \sin(\theta + \alpha)$, with $\alpha \equiv \tan^{-1}[q_{\perp}(0)/q_{||}(0)]$, than α can be interpreted as an effective "minimum angle of incidence". Under conditions where the geometric angle 0 has been made almost grazing the predictions of the simplest model is not adequate to represent the observation made in TORE-SUPRA; a similar result is found in TFTR. Experimental observations of heat and particle deposition on the large area limiter on the inner wall of TORE-SUPRA are presented. These results have been analyzed with a Monte Carlo code describing the diffusion of hydrogenic particles across the LCFS to the limiting objects in the Scrape Off Layer, and by impurity generation calculations using the full "exponential-sine" model used as input to an impurity Monte Carlo code.

34530 (DOE/DP/40200–204) **LLE review: Quarterly report, April–June 1992: Volume 51.** Short, R.W. (ed.). Rochester Univ., NY (United States). Lab. for Laser Energetics. [1992]. 72p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC03-85DP40200. Order Number DE93018333. Source: OSTI; NTIS; GPO Dep.

This volume of the LLE Review, covering the period April–June 1992, contains articles on laser-plasma interaction experiments in long-scale-length plasmas and on the theory of a new form of the stimulated Brillouin scattering instabilitity. The advanced technology section includes reports on the optical response of superconducting films, the development of high-reflectance transport mirrors for the OMEGA Upgrade, and a new high-brightness mono-mode laser oscillator. Finally, the activities of the National Laser Users Facility and the GDL and OMEGA laser systems are summarized.

34531 (DOE/DP/40200–229) **LLE Review quarterly report, July–September 1992: Volume 52.** Short, R.W. (ed.). Rochester Univ., NY (United States). Lab. for Laser Energetics. [1992]. 70p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FC03-85DP40200. Order Number DE93018334. Source: OSTI; NTIS; GPO Dep.

This volume of the LLE Review, covering the period July–September 1992, contains articles on methods of balancing the beam power on the OMEGA Upgrade and on the damping of ion-sound waves in laser-produced plasmas. The advanced technology section includes reports on optical nonlinearities in high-temperature superconductors, a method of increasing gas retention time for laser-fusion targets, and a study of stimulated Raman scattering of laser beams in air. Highlights of the research reported in this issue are: An efficient method has been developed for balancing the power in the 60 beams of the OMEGA Upgrade. The method can achieve 2% power balance for both main and foot beams using only four system shots. A study of ion-sound-wave damping has substantially revised and expanded our knowledge of this effect. The damping of ion waves can have important consequences for laser-plasma interaction. The use of femtosecond laser pulses to study the properties of thin-film, high-temperature superconductors is discussed. A method for increasing the gas retention time of polymer-shell laser-fusion targets by overcoating them with a thin layer of aluminum is described. A code has been developed to study stimulated rotational Raman scattering in high-power laser beams propagating through air.

34532 (DOE/DP/40200–245) **LLE Review quarterly report, October–December 1992: Volume 53.** Meyerhofer, D.D. (ed.). Rochester Univ., NY (United States). Lab. for Laser Energetics. [1992]. 65p. Sponsored by USDOE, Washington, DC (United

States). DOE Contract FC03-85DP40200. Order Number DE93018335. Source: OSTI; NTIS; GPO Dep.

This volume of the LLE Review covers the three-month period October–December 1992. On 18 December, the OMEGA Laser Facility fired its last shot. It will be decommissioned during the next quarter to make room for the OMEGA Upgrade Laser Facility. This volume deals with two areas of interest for the OMEGA Upgrade, the development of advanced x-ray and neutron diagnostics and the development of long-pulse (>1-ns) laser sources. The first three articles discuss the development of time-dependent diagnostics. The development of an x-ray framing camera is described and measurements of the high-voltage pulse propagation in the camera are presented. Time-resolved and time-integrated neutron diagnostics for the OMEGA Upgrade are then discussed. Two schemes for the generation of >1-ns laser pulses are presented. Finally, the activities of the National Laser Users Facility and the GDL and OMEGA laser facilities are summarized.

34533 (DOE/DP/40200–251) **LLE Review quarterly report, January–March 1993: Volume 54.** Meyerhofer, D.D. (ed.). Rochester Univ., NY (United States). Lab. for Laser Energetics. [1993]. 25p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract FC03-92SF19460 ;FC03-85DP40200. Contract PHY-9200542. Order Number DE93017618. Source: OSTI; NTIS; GPO Dep.

This volume of the LLE Review covers the three-month period January–March 1993. The OMEGA laser facility was decommissioned during this quarter to make room for the OMEGA Upgrade laser facility. The decommissioning is described in this volume. Electron thermal transport in the corona and laser-irradiation uniformity are related issues for direct-drive laser fusion. Thermal transport can affect the laser-irradiation uniformity requirements. The status of Fokker-Planck modeling of electron transport at LLE is reviewed and is followed by a description of a new technique for achieving high laser uniformity using zero-correlation phase masks. The use of fast, optically triggered, superconducting opening switches can, in principle, reduce the peak electrical load requirements of systems like the OMEGA Upgrade. Recent research in this area is described. The last three articles discuss vacuum ultraviolet and x-ray emission from short-pulse, laser-matter interactions. The generation of a high spectral brightness, picosecond Kα source is described. The subsequent articles describe the generation of high-order harmonics of a high-intensity laser system laser system in low- density, laser-atom interactions and the novel gas target used.

34534 (DOE/ER–0313/13, pp. 3-4) **Beam-target interaction in an accelerator-based neutron source for a fusion material test facility.** Hassanein, A.; Smith, D. Oak Ridge National Lab., TN (United States). [1992]. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

High-current linear-accelerators have increased the attractiveness of a deuterium-lithium neutron source for fusion materials testing and evaluation. Detailed beam-target interaction and the resulting energy deposited and the jet thermal response are analyzed. Issues relating to jet instabilities, nozzle erosion rates, and the impact of thicker jets on the neutron spectrum at the testing area need further analysis.

34535 (DOE/ER–0313/13, pp. 5-6) **Liquid lithium target development for an accelerator-based neutron source.** Picologlou, B.F.; Smith, D.L. Oak Ridge National Lab., TN (United States). [1992]. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

A proposed high-flux high energy fusion materials irradiation facility uses a deuteron beam impinging on a lithium target to produce neutrons with a spectrum that peaks around 14 MeV. The lithium target consists of a jet of liquid lithium of appropriate thickness. The lithium target development activity is examining the possibility of creating a stable planar free jet of desirable thermal hydraulic characteristics through magnetohydrodynamic body forces created by a DC magnetic field.

34536 (DOE/ER–0313/13, pp. 7-8) **Conceptual designs of superconducting accelerators for a Fusion Materials Irradiation Facility.** Clare, R.B.; Delayen, J.R.; Micklich, B.J. Oak Ridge National Lab., TN (United States). [1992]. DOE Contract W-31109-ENG-38. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

This research has been of a theoretical and analytical nature. The dynamics of high-current beams have been investigated, with the goal of identifying possible instabilities and their cures, and also the causes of emittance growth and halo formation which would lead to activation of the accelerator. Conceptual designs of some of the critical components of the accelerator have been made, and a model has been developed for the control and stabilization of heavily beam loaded superconducting cavities.

34537 (DOE/ER–0313/13, pp. 9-11) **Neutronics analysis of a D-Li neutron source.** Gomes, I.; Gohar, Y.; Smith, D. Oak Ridge National Lab., TN (United States). [1992]. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

Results from preliminary calculations for one beam and dual beam deuterium beam configurations are presented. The influence of the lithium target thickness on the neutron economy of the system has been addressed. The nuclear responses induced by the neutron source has been calculated and a brief discussion about the lack of evaluated nuclear cross section data above 20 MeV is presented.

34538 (DOE/ER–0313/13, pp. 12-20) **The influence of specimen size on measurement of thermal or irradiation creep in pressurized tubes.** Garner, F.A. (Pacific Northwest Laboratory, Richland, VA (US)); Hamilton, M.L.; Kumar, A.S.; Puigh, R.J.; Elholzer, C.R.; Duncan, D.R.; Toloczko, M.B. Oak Ridge National Lab., TN (United States). [1992]. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

Thin-walled pressurized tubes have been developed for measurement of thermal creep and irradiation creep. Miniaturization of these tubes allows more tests to be conducted in the limited reactor space available and decreases the impact of displacement rate gradients and temperature gradients. Studies conducted on a variety of tube sizes show that, when specimen fabrication history and irradiation conditions are controlled, miniaturization can be successfully achieved and valid data produced.

34539 (DOE/ER–0313/13, pp. 21-22) **Status of US/Japan collaborative program phase II HFIR target capsules.** Pawel, J.E. (Oak Ridge National Lab., TN (US)); Senn, R.L. Oak Ridge National Lab., TN (United States). [1992]. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

A complete description and details of the design, construction, and installation of capsules JP-9 through JP-16 has been previously reported. The capsules were installed in the High Flux Isotope Reactor (HFIR) target July 20, 1990 for irradiation beginning with HFIR fuel cycle 289. The capsules were removed and stored in the reactor pool during HFIR cycle 292 (11/25/90 - 12/10/90) to provide room for required isotope production. They were reinstalled for HFIR cycle 293 for continued irradiation. Of these eight target capsules, JP-10, 11, 13, and 16 completed their scheduled number of cycles (11) and were removed from the reactor in September 1991. In addition, JP-14 was removed from the reactor at the end of cycle 310 (9/18/92) after 21 cycles. Three new capsules in this series, JP-20, 21, and 22, are currently being designed. These capsules were added to the program in order to complete the experimental matrix included in the JP-9 through JP-16 capsules. The new capsules will contain transmission electron microscope (TEM) disks and SS-3 flat tensile specimens at 300-600°C and will achieve doses of 8, 18 and 40 dpa, respectively. The preliminary experiment matrix is described in detail in a previous report.

34540 (DOE/ER–0313/13, pp. 23-25) **Fabrication and operation of HFIR-MFE RB spectrally tailored irradiation capsules.** Longest, A.W. (Oak Ridge National Lab., TN (US)); Heatherly, D.W.; Clemmer, E.D. Oak Ridge National Lab., TN (United States). [1992]. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

The objective of this work is to fabricate and operate irradiation capsules for irradiating magnetic fusion energy (MFE) candidate first-wall materials in the High Flux Isotope Reactor (HFIR) removable beryllium (RB*) positions. Japanese and US MFE specimens are being transferred to RB* positions following irradiation to 7.5 dpa at temperatures of 60, 200, 330, and 400°C in Oak Ridge Research Reactor (ORR) experiments ORR-MFE-6J and -7J. Fabrication and operation of four HFIR-MFE RB* capsules (60, 200, 330, and 400°C) to accommodate MFE specimens previously irradiated in spectrally tailored experiments in the ORR are proceeding satisfactorily. With the exception of the 60°C capsule, where the test specimens are in direct contact with the reactor cooling water, specimen temperatures (monitored by 21 thermocouples) are controlled by varying the thermal conductance of a thin gas gap region between the specimen holder outer sleeve and containment tube. Irradiation of the 60 and 330°C capsules was started on July 17, 1990. As of September 30, 1992, these two capsules had completed 22 cycles of their planned 24-cycle (formerly 22-cycle) irradiation to a damage level of approximately 18.3 displacements per atom (dpa). Assembly of the 200 and 400°C capsules is scheduled for completion in November 1992; operation of these two capsules will follow the first two (60 and 330°C).

34541 (DOE/ER–0313/13, pp. 29-41) **Neutron displacement damage cross-sections for SiC.** Huang, H. (Univ. of California, Los Angeles (US)); Ghoniem, N. Oak Ridge National Lab., TN (United States). [1992]. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

The objective of the present study is to develop and apply a computational tool for calculations of neutron displacement cross-sections for SiC in various fission and fusion neutron spectra. Calculations of neutron displacement damage cross-sections for SiC are presented. Biersack and Haggmark's empirical formula is used in constructing the electronic stopping power, which combines the Lindhard's model at low PKA energies and the Bethe-Bloch's model at high PKA energies. The electronic stopping power for polyatomic materials is computed on the basis of Bragg's Additivity Rule. A continuous form of the inverse power law potential is used for nuclear scattering. Coupled intergro- differential equations for the number of displaced atoms j, caused by PKA i, are then derived. The procedure outlined above gives partial displacement cross-sections, displacement cross-sections for each species of the lattice, and for each PKA type. The corresponding damage rates for several fusion and fission neutron spectra are calculated. The stoichiometry of the irradiated material is investigated by finding the ratio of displacements among various atomic species. The role of each specie in displacing atoms is also investigated by calculating the fraction of displacements caused by each PKA type. The study shows that neutron displacement damage rates of SiC in typical magnetic fusion reactor first walls will be ~10-15 $[dpa][MW]^{-1}[m]^2$, that in typical lead-protected inertial confinement fusion reactor first walls to be ~15-20 $[dpa][MW]^{-1}[m]^2$. For fission spectra, the neutron displacement damage rate of SiC is ~74[dpa]per 10^{27}n/m^2 in FFTF, ~39[dpa]per 10^{27} in HFIR, and 25 [dpa] per 10^{27} in NRU. Approximately 80% of displacement atoms are shown to be of the carbon-type.

34542 (DOE/ER–0313/13, pp. 42-47) **Transmutation of copper in FFTF and starfire.** Garner, F.A. (Pacific Northwest Lab., Richland, VA (US)); Greenwood, L.R.; Mann, F.M. Oak Ridge National Lab., TN (United States). [1992]. DOE Contract AC06-76RL01830. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

Calculations of the transmutation of pure copper in the recent MOTA-2A out-of-core experiment yield somewhat different values than expected from previous calculations for earlier MOTA in-core experiments. The differences arise not only from position-dependent spectral variations but also from changes in neutron flux and spectrum associated with the placement of the CDE experiment in FFTF. In addition, there has been a re-evaluation of the cross-sections for transmutation. The resulting differences between the current and earlier predictions for the original FFTF core loading are that the zinc concentration is significantly higher and the nickel concentration is somewhat lower in the current calculation. Relative to the original core loading, however, the production rate per dpa of both nickel and zinc in the MOTA-2A experiment in the current core loading is increased due to spectral softening arising from both the new CDE core and the out-of-core location. Although the nickel transmutation rate increases significantly in the STARFIRE first wall neutron spectrum, the nickel-to-zinc transmutation ratio is also reduced compared to that of previous calculations, with the difference arising only from the re-evaluation of the transmutation cross-sections.

34543 (DOE/ER–0313/13, pp. 55-73) **Analysis of displacement damage and defect production under cascade damage conditions.** Zinkle, S.J. (Oak Ridge National Lab., TN (US)); Singh, B.N. Oak Ridge National Lab., TN (United States). [1992]. DOE Contract AC05-84OR21400. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

The production, annihilation, and accumulation of point defects in metals during displacive irradiation is dependent on a variety of physical conditions, including the nature and energy of the projectile particles and the irradiation temperature. This paper briefly reviews the evolution of the defect population in an isolated displacement cascade, and outlines a proposed framework for identifying the relevant components of displacement damage and defect production under cascade damage conditions. The most significant aspect of energetic cascades is that the concepts of atomic displacements and residual defect production must be treated separately. An evaluation of experimental and computer defect production studies indicates that the overall fraction of defects surviving correlated annihilation in the displacement cascade in copper decreases from about 30% of the Norgett-Robinson-Torrens (NRT) calculated displacements at 4 K to about 10% of the NRT displacements at 300 K. Due to differences in the thermal stability of vacancy versus interstitial clusters, the fractions of freely migrating defects available for inducing microstructural changes at elevated temperatures may be higher for vacancies than for interstitials. The available evidence suggests that the fraction of freely migrating vacancies at temperatures relevant for void swelling in copper is ~5% of the calculated NRT displacements.

34544 (DOE/ER–0313/13, pp. 74-78) **The relationship between the collisional phase defect distribution and cascade collapse efficiency.** Morishita, K. (Univ. of Tokyo (JP)); Ishino, S.; Heinisch, H.L. Oak Ridge National Lab., TN (United States). [1992]. DOE Contract AC06-76RL01830. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

Cascades produced in binary collision simulations of ion-irradiation experiments were analyzed to determine if a correlation exists between the defect distribution in the collisional phase and the number of visible clusters produced directly in cascades (caused by the so-called "collapse" of the cascade defects). The densities of the vacancy distributions in the simulated cascades were compared to the measured cascade collapse efficiencies to obtain the minimum or "critical" vacancy densities required for collapse. The critical densities are independent of the cascade energy for self-ions and exhibit differences with ion mass that are consistent with the cascade energy dissipation characteristics.

34545 (DOE/ER–0313/13, pp. 79-92) **Effects of stress on microstructural evolution during irradiation.** Gelles, D.S. (Pacific Northwest Lab., Richland, VA (US)). Oak Ridge National Lab., TN (United States). [1992]. DOE Contract AC06-76RL01830. (ORNL/M–2722). In *Fusion reactor materials semiannual progress*

report for period ending September 30, 1992. 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

Many theories have been postulated to describe irradiation creep but few have been supported with microstructural evidence. The purpose of this paper is to review microstructural studies of the effects of stress during irradiation in order to assess the validity of the available irradiation creep theories. Microstructural studies based on high voltage electron, ion, proton and neutron irradiation will be described, with major emphasis placed on interpreting behavior demonstrated in austenitic steels. Special attention will be given to work on fast neutron irradiated Nimonic PE16, a precipitation strengthened superalloy.

34546 (DOE/ER–0313/13, pp. 93-100) **Irradiation creep due to SIPA under cascade damage conditions.** Woo, C.H. (Pacific Northwest Lab., Richland, VA (US)); Garner, F.A.; Holt, R.A. Oak Ridge National Lab., TN (United States). [1992]. DOE Contract AC06-76RL01830. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

This paper derives the relationships between void swelling and irradiation creep due to Stress-Induced Preferred Absorption (SIPA) and SIPA-Induced Growth (SIG) under cascade damage conditions in an irradiated pressurized tube. It is found that at low swelling rates irradiation creep is a major contribution to the total diametral strain rate of the tube, whereas at high swelling rates the creep becomes a minor contribution. The anisotropy of the corresponding dislocation structure is also predicted to decline as the swelling rate increases. The theoretical predictions are found to agree very well with experimental results.

34547 (DOE/ER–0313/13, pp. 101-106) **Simulating high energy cascades in metals.** Heinisch, H.L. (Pacific Northwest Laboratory, Richland, VA (US)). Oak Ridge National Lab., TN (United States). [1992]. DOE Contract AC06-76RL01830. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

The processes of radiation damage, from initial defect production to microstructure evolution, occur over a wide spectrum of time and size scales. An understanding of the fundamental aspects of these processes requires a spectrum of theoretical models, each applicable in its own time and distance scales. As elements of this multi-model approach, molecular dynamics and binary collision simulations play complementary roles in the characterization of the primary damage state of high energy collision cascades. Molecular dynamics is needed to describe the individual point defects in the primary damage state with the requisite physical reality. The binary collision approximation is needed to model the gross structure of statistically significant numbers of high energy cascades. Information provided by both models is needed for connecting the defect production in the primary damage state with the appropriate models of defect diffusion and interaction describing the microstructure evolution. Results of binary collision simulations of high energy cascade morphology are reviewed. The energy dependence of freely migrating defect fractions calculated in recent molecular dynamics simulations are compared to results obtained much earlier with a binary collision/annealing simulation approach. The favorable agreement demonstrates the viability of the multi-model approach to defect production in high energy cascades.

34548 (DOE/ER–0313/13, pp. 107-108) **Swelling of pure nickel observed in the second discharge of the AA-14 experiment.** Garner, F.A. (Pacific Northwest Lab., Richland, VA (US)). Oak Ridge National Lab., TN (United States). [1992]. DOE Contract AC06-76RL01830. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

The swelling of neutron-irradiated pure nickel is strongly dependent on its tendency toward saturation. The factors which induce saturation also lead to a strong dependence on irradiation temperature for nickel in the annealed condition. When irradiated in the cold-worked condition, however, the temperature dependence of swelling is strongly reduced but the tendency toward saturation persists.

34549 (DOE/ER–0313/13, pp. 109-114) **Completion of the ORR/MFE-4 experiment involving high rates of helium generation in Fe-Cr-Ni alloys.** Sekimura, N. (Univ. of Tokyo (JP)); Garner, F.A. Oak Ridge National Lab., TN (United States). [1992]. DOE Contract AC06-76RL01830. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

Completion of the microscopy examination of the ORR/MFE-4 experiment confirms the conclusions reached earlier in this study. Helium generated at very high levels (~30 to 60 appm/dpa) does indeed strongly influence the microstructural evolution of Fe-Cr-Ni austenitic alloys, especially when the temperature history involves a large number of low temperature excursions. Under these conditions the effect of composition and starting condition are relatively unimportant.

34550 (DOE/ER–0313/13, pp. 115-117) **^{59}Ni isotopic tailoring experiment: Results of tensile test on MOTA-1G specimens.** Hamilton, M.L. (Pacific Northwest Lab., Richland, VA (US)); Garner, F.A. Oak Ridge National Lab., TN (United States). [1992]. DOE Contract AC06-76RL01830. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

Tensile tests have been conducted on the last two groups of isotopic tailoring specimens discharged from MOTA-1G. The results agree with those reported earlier, showing a very small impact of fusion-relevant helium/dpa levels on neutron-induced changes in tensile properties of three model austenitic alloys.

34551 (DOE/ER–0313/13, pp. 118-130) **Microstructural evolution in irradiatd Fe-Cr-M alloys: Solute effects.** Gelles, D.S. (Pacific Northwest Laboratory, Richland, VA (US)). Oak Ridge National Lab., TN (United States). [1992]. DOE Contract AC06-76RL01830. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

A series of alloys based on Fe-10Cr with solute additions of silicon, vanadium, manganese, tungsten, tantalum, and zirconium at 0.1 and 1.0% levels, has been examined by transmission electron microscopy following fast neutron irradiation. Marked differences in dislocation evolution and void shape following neutron irradiation were found as a function of alloying. The present study extends previous examinations by investigating microstructural response following irradiation at a lower temperature (365°C) to 30 dpa and to a higher dose, 100 dpa, at 410°C. Swelling level, void shape, and dislocation configuration continued to vary as a function of the various solutes present in the same manner as seen previously. However, two additional observations were made. Irradiation at the lower temperature promotes precipitation of chromium rich α' phase and reduces microstructural evolution. Also, irradiation to higher dose, reduces the effect each solute exerts by lessening the wide variation in void shape and dislocation evolution that were found at lower dose.

34552 (DOE/ER–0313/13, pp. 131-137) **Postirradiation deformation behavior in ferritic Fe-Cr alloys.** Hamilton, M.L. (Pacific Northwest Lab., Richland, VA (US)); Gelles, D.S.; Gardner, P.L. Oak Ridge National Lab., TN (United States). [1992]. DOE Contract AC06-76RL01830. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

It has been demonstrated that fast neutron irradiation produces significant hardening in simple Fe(3-18)Cr binary alloys irradiated to about 35 dpa in the temperature range 365 to 420°C, whereas irradiation at 574°C produces hardening only for 15% or more chromium. The irradiation-induced changes in tensile properties are discussed in terms of changes in the power law work hardening exponent. The work hardening exponent of the lower chromium alloys decreased significantly after low temperature irradiation ($\leq$420°C) but increased after irradiation at 574°C. The higher chromium alloys failed either in cleavage or in a mixed ductile/brittle fashion. Deformation microstructures are presented to support the tensile behavior.

34553 (DOE/ER–0313/13, pp. 141-150) **Charpy impact toughness of martensitic steels irradiated in FFTF: Effect of heat treatment.** Klueh, R.L. (Oak Ridge National Lab., TN (US)); Alexander, D.J. Oak Ridge National Lab., TN (United States). [1992]. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

Plates of 9Cr-1MoVNb and 12Cr-1 MoVW steels were normalized and then tempered at two different tempering conditions. One-third-size Charpy specimens from each steel were irradiated to 7.4-8$\times 10^{26}$ n/m^2 (about ~35 dpa) at 420°C in the Materials Open Test Assembly (MOTA) of the Fast Flux Test Facility. Specimens were also thermally aged to 20,000 h at 400°C to compare the effect of aging and irradiation. Previous work on the steels irradiated to 4-5 dpa at 365°C in MOTA were reexamined in light of the new results. The tests indicated that prior-austenite grain size, which was varied by different normalizing treatments, had an effect on impact behavior of the 9Cr-1MoVNb but not on the 12Cr-1MoVW. Tempering treatment had relatively little effect on the shift in DBTT for both steels. Conclusions are presented on how heat treatment can be used to optimize properties.

34554 (DOE/ER–0313/13, pp. 151-156) **Relationship of bainitic microstructure to impact toughness in Cr-Mo and Cr-W steels.** Klueh, R.L. (Oak Ridge National Lab., TN (US)); Alexander, D.J. Oak Ridge National Lab., TN (United States). [1992]. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

Non-classical bainite microstructures can develop during continuous cooling of low-carbon alloy steels. These differ from classical upper and lower bainite developed by isothermal transformation. Two non-classical bainite microstructures were produced in a 3Cr-1.5Mo-0.25V-0.1C steel using different cooling rates after austenitizing–water quenching and air cooling. The carbide-free acicular bainite formed in the quenched steel had a lower ductile-brittle transition temperature (DBTT) than the granular bainite formed in the air-cooled steel. With increasing tempering parameter, the DBTT of both decreased and approached a common value, although the final value occurred at a much lower tempering parameter for the quenched steel than for the air-cooled steel. The upper-shelf energy was similarly affected by microstructure. These observations along with similar observations in two Cr-W steels indicate that control of the bainite microstructure can be used to optimize strength and toughness.

34555 (DOE/ER–0313/13, pp. 157-167) **Reduced activation ferritic alloys for fusion.** Gelles, D.S. (Pacific Northwest Lab., Richland, VA (US)). Oak Ridge National Lab., TN (United States). [1992]. DOE Contract AC06-76RL01830. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

Reduced activation martensitic alloys can now be developed with properties similar to commercial counterparts, and oxide dispersion strengthened alloys are under consideration. However, low chromium Bainitic alloys with vanadium additions undergo severe irradiation hardening at low irradiation temperatures and excessive softening at high temperatures, resulting in a very restricted application window. Manganese additions result in excessive embrittlement, as demonstrated by post-irradiation Charpy impact testing. The best composition range for martensitic alloys appears to be 7 to 9 Cr and 2 W, with swelling of minor concern and low temperature irradiation embrittlement perhaps eliminated. Therefore, reduced activation martensitic steels in the 7 to 9 Cr range should be considered leading contenders for structural materials applications in power-producing fusion machines.

34556 (DOE/ER–0313/13, pp. 168-173) **Mechanical properties of martensitic alloy AISI 422.** Hamilton, M.L. (Pacific Northwest Lab., Richland, VA (US)); Huang, F.H.; Hu, W. Oak Ridge National Lab., TN (United States). [1992]. DOE Contract AC06-76RL01830. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

HT9 is a martensitic stainless steel that has been considered for structural applications in liquid metal reactors (LMRs) as well as in fusion reactors. AISI 422 is a commercially available martensitic stainless steel that closely resembles HT9, and was studied briefly under the auspices of the US LMR program. Previously unpublished tensile, fracture toughness and charpy impact data on AISI 422 were reexamined for potential insights into the consequences of the compositional differences between the two alloys, particularly with respect to current questions concerning the origin of the radiation-induced embrittlement observed in HT9.

34557 (DOE/ER–0313/13, pp. 179-181) **Status of the dynamic helium charging experiment (DHCE).** Loomis, B.A. (Pacific Northwest Lab., Richland, VA (US)); Smith, D.L.; Hamilton, M.L.; Greenwood, L.R.; Clemmer, R.G.; Matsui, H.; Pearce, K.L.; Kopasz, J.P.; Johnson, C.E. Oak Ridge National Lab., TN (United States). [1992]. DOE Contract W-31109-ENG-38. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

The objective of this experiment is to provide baseline irradiation data on the effects of concurrent helium production and neutron irradiation on the physical and mechanical properties of vanadium alloys. Effects of helium production and irradiation on the alloy microstructures will also be characterized. This report summarizes the status of the DHCE in FFTF-MOTA, the preparations for retrieval of specimens from the irradiation capsules, and experimental results on procedures for the removal of tritium from the irradiated specimens.

34558 (DOE/ER–0313/13, pp. 182-186) **Hydrogen embrittlement of niobium-base alloys for application in the ITER divertor.** Peterson, D.T.; Hull, A.B.; Loomis, B.A. Oak Ridge National Lab., TN (United States). [1992]. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

The corrosion rate of Nb alloys in high-purity water was demonstrated to be quite low at 300°C and only a fraction of the hydrogen (H) produced by corrosion was absorbed. The calculated H concentrations in an ITER divertor plate are below levels expected to cause embrittlement. Corrosion, H absorption, and resistance to embrittlement of Nb can be significantly improved by alloying. Alloying of Nb can increase the terminal solid solubility of H in Nb-V alloys. Consequently, alloying Nb with V reduces the embrittlement caused by H. Hence, there appear to be good prospects for increasing the solubility of the hydride phase and of increasing the tolerance for H by developing appropriate Nb alloys. Thermotransport of H may perturb H concentration and thus needs further evaluation.

34559 (DOE/ER–0313/13, pp. 187-193) **Tensile properties of vanadium-base alloys with a tungsten/inert-gas weld zone.** Loomis, B.A.; Konicek, C.F.; Nowicki, L.J.; Smith, D.L. Oak Ridge National Lab., TN (United States). [1992]. DOE Contract W-31109-ENG-38. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

The tensile properties of V-(0-20)Ti and V-(O-15)Cr-5Ti alloys after butt-joining by tungsten/inert-gas (TIG) welding were determined from tests at 25°C. Tensile tests were conducted on both annealed and cold-worked materials with a TIG weld zone. The tensile properties of these materials were strongly influenced by the microstructure in the heat-affected zone adjacent to the weld zone and by the intrinsic fracture toughness of the alloys. TIG weld zones in these vanadium-base alloys had tensile properties comparable to those of recrystallized alloys without a weld zone. Least affected by the TIG welding were tensile properties of the V-5Ti and V-5Cr-5Ti alloys. Although the tensile properties of the V-5Ti and V- 5Cr-5Ti alloys with a TIG weld zone were acceptable for structural material, these properties would be improved by optimization of the welding parameters for minimum grain size in the heat-affected zone.

34560 (DOE/ER–0313/13, pp. 194-202) **Effects of irradiation-induced precipitation on properties of vanadium alloys.** Chung, H.M. Oak Ridge National Lab., TN (United States). [1992]. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

Two major and two minor types of irradiation-induced precipitates were identified in V-Ti, V-Cr-Ti, and V-Ti-Si alloys after neutron irradiation in the Fast Flux Test Facility (FFTF) at 420 and 600°C to fluences up to 114 dpa. The major precipitates are Ti_5Si_3 and Ti_2O phases. Effects of irradiation temperature and dose on the two major types of precipitation were examined after irradiation at 420, 600, and 600°C plus an excursion to 850°C for 50 min. Precipitation of the very fine Ti_5Si_3 particles at 420°C increases monotonically with increasing dose, whereas at 600°C the maximum precipitation occurs at ~20-40 dpa. The characteristic precipitation kinetics were consistent with swelling and elongation behavior observed for the low and high irradiation temperatures. For operation at 420°C, it is important to optimize the Si level and ensure sufficient Ti "in solution" (i.e., Ti solutes not bound to thermal precipitates), and thereby optimizing the precipitation of Ti_5Si_3. For operation at 600°C, minimizing the O content, in addition to Si and Ti control, is important in minimizing Ti_2O precipitation.

34561 (DOE/ER–0313/13, pp. 203-213) **Preliminary assessment of candidate niobium alloys for divertor structures.** Todd, J.A.; Purdy, I.M. Oak Ridge National Lab., TN (United States). [1992]. DOE Contract W-31109-ENG-38. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

Corrosion rates of several Nb-base alloys that contain ~2.5 at. % Zr, V, Hf, Ti, Ta, Mo, or W were determined in HP deoxygenated water at 300°C. Microstructural characteristics of the corrosion-product layers were examined by optical and scanning electron microscopy (SEM). Although the weight-gain corrosion rates were not excessive and only a fraction (<20%) of the hydrogen liberated by the overall corrosion reaction was absorbed by the alloys, most of the alloys were deemed to be brittle, i.e., fracture occurred during a 90° bend test. The microstructural evaluations revealed numerous cracks and spalling of the oxide layers; this is characteristic of nonprotective film formation. Some of the crack surfaces in the alloys were covered by corrosion product, indicating that the cracks formed during exposure to high-temperature water. The present results suggest that Nb alloys with higher concentrations of alloying elements are required to improve the protective nature of the corrosion-product layers and to decrease hydrogen uptake and embrittlement. Procurement of candidate alloys is in progress and corrosion/H_2-embrittlement tests will be conducted at lower temperatures to determine material operating conditions that will lead to adequate performance of alloys as structural materials in the ITER divertor.

34562 (DOE/ER–0313/13, pp. 214-216) **Creep of V-5Cr-5Ti and V-10Cr-5Ti alloys at 600°C.** Loomis, B.A.; Nowicki, L.J.; Smith, D.L. Oak Ridge National Lab., TN (United States). [1992]. DOE Contract W-31109-ENG-38. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

The objective of this research is to determine the composition of a vanadium base alloy with the optimal combination of mechanical properties, corrosion resistance, fabricability, and weldability for use as a structural material in the environment of a magnetic fusion reactor. Creep tests were conducted on V-5Cr-5Ti and V-10Cr-5Ti alloys at 600°C. The results of these tests show that the V-10Cr-5Ti alloy has significantly higher creep strength than the V-5Cr-5Ti alloy.

34563 (DOE/ER–0313/13, pp. 217-221) **Relationship of hardness and tensile strength of vanadium and vanadium-base alloys.** Loomis, B.A.; Gazda, J.; Nowicki, L.J.; Smith, D.L. Oak Ridge National Lab., TN (United States). [1992]. DOE Contract W-31109-ENG-38. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

The Vickers hardness numbers (VHNs) of annealed and recrystallized vanadium and V-(0-15)Cr-(0-5)Ti-(0-1)Si alloys were determined at 25°C. The relationship between the VHN and the tensile strength of these materials previously reported by Loomis et al. are presented in this report. These results show that the VHN, yield strength (YS), and ultimate tensile strength (UTS) of V-(0-15)Cr-5Ti alloys at 25°C have a similar dependence on Cr concentration and that the VHN, YS, and UTS of V-(0-20)Ti alloys at 25°C have a similar dependence on Ti concentration. On the basis of these results and the small size of the test specimen, it is recommended that the Vickers hardness test be utilized in the vanadium alloy development program to determine the effects of thermal-mechanical treatment, impurities (i.e., O, N, C, H, and Si), and irradiation on tensile properties of vanadium-base alloys.

34564 (DOE/ER–0313/13, pp. 222-226) **Correlation of microstructure and mechanical properties of vanadium-base alloys.** Gazda, J. (Univ. of Illinois, Chicago (US)); Danyluk, S.; Loomis, B.A.; Smith, D.L. Oak Ridge National Lab., TN (United States). [1992]. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

The mechanical properties and microstructure of V, V-3Ti-1Si, and V-5Ti alloys were investigated by microhardness testing, optical microscopy, and transmission electron microscopy (TEM). The microhardness data were related to tensile test data reported by Loomis et al. The microhardness and tensile strength of these materials were related to the number density of precipitates. The most common precipitates were identified as: V_6O_{13} and VS_4 for vanadium; Ti(C,N,O) and various forms of Ti-S for V-3Ti-1Si; Ti(C,N,O) and TiN for V-5Ti. The crystallographic lattice parameters for these alloys were determined by X-ray diffraction.

34565 (DOE/ER–0313/13, pp. 227-234) **Effects of impurities and doping elements on phase structure of vanadium-base alloys containing titanium.** Satou, M.; Chung, H.M. Oak Ridge National Lab., TN (United States). [1992]. DOE Contract W-31109-ENG-38. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

The thermal phase structure of vanadium-base alloys that contain Ti is strongly influenced by impurities. When the combined concentration of O, N, and C is >500 wt. ppm, Ti solutes form blocky Ti(O,N,C) precipitates during fabrication. When the O+N+C level is 400 wt. ppm, the Ti(O,N,C) phase is absent. With Si and Y in the alloy, Ti solutes form Ti_5Si_3 and $(Y,Si_{1-x})_2O_3$ precipitates. A low impurity concentration and Y doping promote preservation of Ti atoms in solution. Swelling of V-5Cr-5Ti specimens doped with Si, Y, and Al was low after irradiation at 406 and 600°C. The excellent resistance to swelling is attributed to dense distribution of ultrafine Ti_5Si_3 and Y_2O_3 like precipitates that are formed during irradiation and provide a large number of sinks for vacancies; and hence, they effectively suppress nucleation of voids during irradiation.

34566 (DOE/ER–0313/13, pp. 235-237) **Influence of boron-generated helium on the swelling of neutron-irradiated pure vanadium and vanadium-5% chromium.** Sekimura, N. (Univ. of Tokyo (JP)); Garner, F.A. Oak Ridge National Lab., TN (United States). [1992]. DOE Contract AC06-76RL01830. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

In agreement with earlier reports, the addition of five weight percent chromium to pure vanadium leads to a significant increase in neutron-induced void swelling at 600°C. Although the swelling of V-5Cr increases strongly with irradiation temperature, the influence of chromium is reversed at lower temperatures, with pure vanadium swelling more than V-5Cr. The use of boron additions to generate large amounts of helium in V and V-5Cr leads to a very complex swelling response, depending on boron level, chromium level and irradiation temperature. The most pronounced response occurs in V-5Cr at 600°C, where boron levels of 100 appm or greater cause a significant reduction in swelling. The complexity of swelling response is thought to result from the competition between helium effects and the separate chemical effects of boron and

lithium, each of which may exhibit its own dependence on irradiation temperature.

34567 (DOE/ER–0313/13, pp. 238-249) **Compatibility of vanadium alloys with reactor-grade helium for fusion reactor.** Bell, G.E.C. (Oak Ridge National Lab., TN (US)); Bishop, P.S. Oak Ridge National Lab., TN (United States). [1992]. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

Miniature tensile specimens of V-5Cr-5Ti, V-10Cr-5Ti, and V-12.5Cr-5 Ti were exposed in a once-through system to helium with 70 vppm-H_2 (measured oxygen partial pressures of 10^{-12} atm) and bottle helium (measured oxygen partial pressures of 10^{-4} atm) between 500 and 700°C for up to 1008 h. The weight changes in the specimens were recorded. The helium-exposed specimens were tensile tested, and the effects of exposure on mechanical properties were assessed. Exposure between 500 and 700°C for 1008 h in He+70 vppm-H_2 resulted in complete embrittlement of all the alloys in room temperature tensile tests. The fracture mode was primarily cleavage, probably caused by a hydrogen-induced shift in the ductile to brittle transition temperature (DBTT). Weight gains increased with temperature and were largest for the V-5Cr-5Ti alloy. Specimens exposed for 531 h between 500 and 700°C in bottle He exhibited two distinct fracture morphologies on the fracture surfaces. Brittle cleavage around the edges of the specimens gave way to ductile dimpling in the center of the specimens. The brittle region around the periphery of the specimen is most likely the higher vanadium oxide, V_2O_5.

34568 (DOE/ER–0313/13, pp. 253-254) **Swelling of copper alloys irradiated in MOTA 2A.** Garner, F.A. (Pacific Northwest Lab., Richland, VA (US)); Edwards, D.J.; Singh, B.N.; Watanabe, H. Oak Ridge National Lab., TN (United States). [1992]. DOE Contract AC06-76RL01830. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

Density measurements have been completed on copper alloys irradiated in MOTA 2A at (375°C, 12.7 dpa) and (423°C, 48.0 dpa). While most of the density changes observed are consistent with those of earlier studies, there were several surprises. The role of cold work on swelling of Cu-5Ni is relatively small and Cu-5Mn does not appear to swell at all.

34569 (DOE/ER–0313/13, pp. 255-257) **Cobra-1A copper irradiation experiment in EBR-II.** Garner, F.A (Pacific Northwest Lab., Richland, VA (US)); Hamilton, M.L.,. Oak Ridge National Lab., TN (United States). [1992]. DOE Contract AC06-76RL01830. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

The objective of this effort is to provide data on the radiation response of copper alloys selected as candidates for divertor service in ITER and other fusion devices. Specimen preparation for copper alloys to be irradiated in EBR-II Run 162 in the COBRA irradiation vehicle is complete. Specimens include TEM disks, miniature tensile and miniature fatigue specimens.

34570 (DOE/ER–0313/13, pp. 258-264) **The influence of transmutation and void swelling on the electrical properties of copper and several copper alloys.** Edwards, D.J. (Pacific Northwest Lab., Richland, VA (US)); Garner, F.A. Oak Ridge National Lab., TN (United States). [1992]. DOE Contract AC06-76RL01830. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

A comparison of the predicted and measured electrical conductivities of MARZ copper wand two copper alloys irradiated in FFTF shows that the calculated transmutation rates are ~15% higher than those required to produce the observed changes. It also appears that the contribution of transmutants and void swelling to conductivity changes are directly additive. Of the several models available, Euken's model has been found to best describe the contribution of void swelling.

34571 (DOE/ER–0313/13, pp. 265-266) **Status of low cycle fatigue studies on irradiated copper.** Garner, F.A. (Pacific Northwest Lab., Richland, VA (US)); Singh, B.N.; Stubbins, J.F. Oak Ridge National Lab., TN (United States). [1992]. DOE Contract AC06-76RL01830. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

A joint irradiation program is being conducted by the Riso National Laboratory, Pacific Northwest Laboratory and the University of Illinois to study the influence of neutron irradiation on the low cycle fatigue behavior of copper alloys. This program is directed toward both NET and ITER goals. Radiation is proceeding on miniature specimens in the DR-3 reactor in Riso, and identical specimens have been prepared for the COBRA-1A experiment in EBR-II. A size effect study on unirradiated specimens is in progress.

34572 (DOE/ER–0313/13, pp. 269-275) **Development of electrical insulator coatings for liquid-metal blanket applications.** Park, J.H.; Fox, M.R.; Dragel, G. Oak Ridge National Lab., TN (United States). [1992]. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

Based on a preliminary survey of more than 15 oxides and nitrides, four ceramic materials (CaO, MgO, Y^2O^3, and BN) were identified as candidates for insulator coating development. These compounds were fabricated by various techniques and exposed to flowing Li at 400-410° to assess chemical compatibility. Yttrium oxide exhibited excellent corrosion resistance in flowing liquid Li at 400°C; its corrosion rate was calculated to be 0.042 μm/hr. Resistivity measurements by a standard four-probe method on Y^2O^3 in air at temperatures between ~450 and 1000°C, before and after exposure to Li for 675 h at 410°C, indicated no deterioration in resistivity. The resistivity of in-situ-formed $(V,Ti)^xN$ reaction-product layers on V-20Ti and TiN on Ti was determined at room temperature and 80°C by a two-probe method. The resistivity of the film on the V-20Ti alloy was low (~20 Ωm) and the film on Ti exhibited metallic conduction. Adhesion bonding between Y^2O^3 and Y, V, Ti, Y, V-20Ti, V-3Ti-1Si, and Types 304 and 316 stainless steel was investigated in reducing and oxidizing gaseous environments at 927°C. Except for the V-20Ti alloy, the V-base alloys, Ti, and Type 304 stainless steel were well bonded to Y^2O^3 in the reducing atmosphere. In the oxidizing atmosphere, bond regions of Types 304 and 316 stainless steel were better than in the reducing atmosphere because of reaction between the oxide scale on the steels (Cr^2O^3) and Y^2O^3 to form $YCrO^3$. Neither V, Ti, nor the V-alloys bonded with Y^2O^3. These results suggest that a low-melting eutectic layer forms between Y^2O^3 and the oxides layers present on V, Ti, and V-alloys.

34573 (DOE/ER–0313/13, pp. 276-284) **Aqueous stress corrosion of candidate austenitic steels for iter structural applications.** French, D.M.; Soppet, W.K.; Kassner, T.F. Oak Ridge National Lab., TN (United States). [1992]. DOE Contract W-31109-ENG-38. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

Susceptibility of Types 316NG and sensitized 304 stainless steels (SS) to SCC was investigated at temperatures of 60-289°C in slow-strain-rate-tensile (SSRT) tests in oxygenated water that simulates important parameters anticipated in first-wall/blanket systems. Several additional SSRT tests were performed on crevice specimens of Type 316NG SS in oxygenated water containing 100 ppb sulfate at temperatures between 150 and 289°C to establish the effect of temperature on SCC resistance. This steel exhibits good resistance to SCC under crevice and noncrevice conditions at temperatures <150°C in a nominal ITER coolant chemistry. In contrast, sensitized Type 304 SS exhibited intergranular stress corrosion cracking (IGSCC) at <100°C under crevice conditions. SSRT tests have been conducted on weldment specimens of Type 316L SS with matching filler metal under crevice conditions in oxygenated water containing 0.06-6.0 ppm chloride at 150-225°C. Most specimens fractured in the base metal, and several others

fractured in the heat-affected zone (HAZ) of the weld, but none failed in the weld metal.

34574 (DOE/ER–0313/13, pp. 285-289) **Development of in-situ-formed electrical insulator coatings on high-temperature alloys in lithium.** Park, J.H.; Dragel, G. Oak Ridge National Lab., TN (United States). [1992]. DOE Contract W-31109-ENG-38. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

Various intermetallic films were produced on vanadium, vanadium-base alloys, and Types 304 and 316 stainless steel (SS) by exposing the materials to liquid- and/or vapor-phase lithium containing dissolved elements (3-5 at. %) in sealed capsules at temperatures between 600 and 775°C. After each test, the capsules were opened and the samples were examined by optical and scanning electron microscopy; they were then analyzed by electron-energy-dispersive and X-ray diffraction techniques. The nature of the coatings, i.e., surface coverage, thickness, and composition, varied with exposure time and temperature, solute in lithium, and alloy composition. Solute elements that yielded adherent coatings on various substrates provide a means of developing in-situ electrical insulator coatings by oxidation of the reactive layers with dissolved oxygen and/or nitrogen in liquid lithium.

34575 (DOE/ER–0313/13, pp. 290-294) **Electrical insulator coatings for liquid-metal blanket applications-yttria coating on vanadium.** Fox, M.R.; Park, J.H. Oak Ridge National Lab., TN (United States). [1992]. DOE Contract W-31109-ENG-38. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

Research has been conducted to develop a diffusion coating of Y^2O^3 on the surface of V, which could help eliminate the MHD effect. The process involves yttriding, in which a diffusion coating of Y is formed on the surface of V by immersing the samples in a molten salt and applying a potential. The yttrium layer can then be oxidized to form the electrical insulator Y^2O^3. An yttrium coating up to 10 μm in thickness with a diffusion zone of ~1 μm has been produced.

34576 (DOE/ER–0313/13, pp. 297-301) **Tritium release from ceramic breeder materials.** Kopasz, J.P.; Seils, C.A.; Johnson, C.E. Oak Ridge National Lab., TN (United States). [1992]. DOE Contract W-31109-ENG-38. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

Lithium aluminate is an attractive material (in terms of its chemical, mechanical, and irradiation properties) for breeding tritium in fusion reactors; however, its tritium release characteristics are not as good as those of other candidate materials. To investigate whether tritium release from lithium aluminate can be improved, tritium release has been studied from irradiated samples of lithium aluminate, lithium aluminate doped with magnesium, and lithium aluminate with a surface deposit of platinum. The release was studied using the Temperature Programmed Desorption (TPD) method. Both the platinum coating and magnesium doping were found to improve the tritium release characteristics as determined by TPD. Tritium release shifted to lower activation energies for the altered materials. In addition, information gained from the TPD experiments on the pure material were used to improve a tritium release model. The new model containing no adjustable parameters was used to successfully model in-pile tritium release from $LiA1O_2$.

34577 (DOE/ER–0313/13, pp. 302-304) **Tritium modeling/ BEATRIX-II data analysis.** Billone, M.C.; Attaya, H.; Johnson, C.E.; Kopasz, J.P. Oak Ridge National Lab., TN (United States). [1992]. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

Models have been developed to describe the tritium transport in Li_2O. The mechanisms considered are bulk diffusion, surface desorption, surface adsorption, and solubility. These models have been incorporated into the TIARA steady-state inventory code and the DISPL2 steady-state and transient code. Preliminary validation efforts have focused on the inventory and tritium release rate data from in-reactor, purge-flow tests VOM-15H, EXOTIC-2, CRITIC-1, and MOZART. The models and validation effort are reported in detail in ANL/FPP/TM-260. Since the BEATRIX-II data were released officially in November 1991, validation efforts have been concentrated on the tritium release rate data from the "isothermal" thin-ring sample. In this report, results are presented for the comparison of predicted long-time inventory changes (in response to temperature and hydrogen purge pressure changes) to values determined from the tritium release data.

34578 (DOE/ER–0313/13, pp. 305-307) **Desorption characteristics of the Li_2O system.** Fischer, A.K.; Johnson, C.E. Oak Ridge National Lab., TN (United States). [1992]. DOE Contract W-31109-ENG-38. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

Preparations were completed for temperature programmed desorption (TPD) measurements of the kinetics of desorption from the D_2-H_2-HD-HDO-H_2O-Li_2O system. These preparations consisted of a series of blank and calibrating runs to determine the effects of the empty sample tube on the TPD spectra and to calibrate the mass spectrometer for the gaseous species of interest. Data from the blank tube runs revealed the importance of isotope exchange reactions in interpreting desorption data. A preliminary examination was made of the raw spectra of desorption from Li_2O that had been treated with Ar-D_2 (921 vppm) at temperatures of 374, 673, 873, and 1108 K (200, 400, 600, and 835°C). The TPD spectra appear to contain fewer peaks than were observed earlier for $LiA10_2$.

34579 (DOE/ER–0313/13, pp. 308-311) **Tritium transport in single crystal $LiAlO_2$.** Kopasz, J.P.; Seils, C.A.; Johnson, C.E. Oak Ridge National Lab., TN (United States). [1992]. DOE Contract W-31109-ENG-38. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

Tritium transport in $LiA10_2$ has been studied by performing isothermal anneals followed by sectioning of the sample to determine the tritium concentration profiles within the sample. The anneals were performed over the 528 to 783°C temperature range under a He + 0.1%H_2 purge gas flow. The results indicate that: (1) tritium diffusion in $LiA10_2$ is fast, and is not sensitive to impurities, and (2) tritium release for these samples is in the mixed diffusion-desorption regime. For samples with a grain size of 100 μm or less, the tritium release will be desorption controlled.

34580 (DOE/ER–0313/13, pp. 312-317) **Neutron irradiation of beryllium: Recent Russian results.** Gelles, D.S. (Pacific Northwest Lab., Richland, VA (US)). Oak Ridge National Lab., TN (United States). [1992]. DOE Contract AC06-76RL01830. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

Results on postirradiation tensile and compression testing, swelling and bubble growth during annealing for various grades of beryllium are presented. It is shown that swelling at temperatures above 550°C is sensitive to material condition and response is correlated with oxygen content. Swelling on the order of 15% can be expected at 700°C for doses on the order of 10^{22} n/cm^2. Bubble growth response depends on irradiation fluence.

34581 (DOE/ER–0313/13, pp. 321-325) **Measurement of electrical and optical properties of dielectric materials during neutron irradiation.** Farnum, E.H.; Clinard, F.W.; Kennedy, J.C.; Sommer, W.F.; Unruh, W.P. Oak Ridge National Lab., TN (United States). [1992]. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

An irradiation experiment was carried out during the summer of 1992 at the Los Alamos Spallation Radiation Effects Facility (LASREF). In situ measurements of electrical conductivity in alumina, sapphire and mineral-insulated electrical cables were made at 640°C, 590°C and 400°C. Both DC and AC (100 Hz to 1 MHz) measurements were made to a fluence of approximately 2 x 10^{23} n/m^2. Optical absorption from 200 nm to 800 nm was measured in

pure silica- and OH-doped silica-core optical fibers during the irradiation. A large number of passive samples were included in the irradiation, some at the furnace temperatures and some at ambient temperature. Data is being analyzed during the first quarter of FY93. All samples will be recovered for post-irradiation examination during the second quarter of FY93.

34582 (DOE/ER–0313/13, pp. 326-329) **The effect of vacancies on the thermal conductivity of single crystal alumina (sapphire) at low temperatures.** White, D.P. (Oak Ridge National Lab., TN (US)). Oak Ridge National Lab., TN (United States). [1992]. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

The effect of radiation on the thermal conductivity of alumina is an important design consideration in the development of microwave windows for ion cyclotron resonance heating (ICRH) systems for the heating of plasmas in fusion reactors. Several recent papers have addressed this question at higher temperatures and the present report extends the calculation of the effect of point defects to low temperatures. This extension of the calculations to low temperatures is of interest because it has been proposed to cool these windows to liquid nitrogen temperatures in order to take advantage of the much higher thermal conductivity of alumina at these temperatures.

34583 (DOE/ER–0313/13, pp. 330-340) **Fatigue crack growth of SiC/SiC at 1100°C.** Jones, R.H. (Pacific Northwest Lab., Richland, WA (US)); Henager, C.H. Oak Ridge National Lab., TN (United States). [1992]. DOE Contract AC06-76RL01830. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

Fatigue crack growth tests have been conducted on a SiC/SiC composite at 1100°C and a stress intensity ratio of 0.1. Tests were conducted in pure Ar and Ar + 2000 ppm O_2 to determine the effects of an oxidizing environment. The crack growth rate-stress intensity relationship exhibits a K independent regime, stage II, which is not exhibited in monolithic ceramics. The crack velocity in this stage II regime ranged from a low of 10^{-8} m/s to a high of 10^{-7} m/s. Cyclic stresses were found to decrease the crack velocity relative to static loads while oxygen increased the crack velocity. Both effects are consistent with a model developed to describe the subcritical crack growth of these materials where the fibers bridging the crack wake produce crack closure forces which reduce the crack tip K value. The decrease in crack velocity with cyclic loading resulted primarily from the longer hold-times at a given K value without any apparent cyclic damage. Based on these tests and other published data, cyclic stresses may not pose a fatigue concern for SiC/SiC if the stresses are below the proportional limit and the stress or stress intensity ratio is >0 and tension-tension. Further tests are in progress to evaluate the effect of hold-time on crack growth rates in SiC/SiC.

34584 (DOE/ER–0313/13, pp. 341-345) **Radiation enhanced conductivity in silicon carbide materials.** Snead, L.L. (Oak Ridge National Lab., TN (US)); Ohland, M.; Vesey R.A. Oak Ridge National Lab., TN (United States). [1992]. (ORNL/M–2722). In *Fusion reactor materials semiannual progress report for period ending September 30, 1992.* 378p. Order Number DE93013462. Source: OSTI; NTIS; INIS.

The radiation enhanced conductivity (REC) in four types of silicon carbide based materials was measured. As expected, the material with the highest initial conductivity showed the lowest conductivity enhancement. Chemically vapor deposited material showed only a few percent change at ionizing fluxes of several Gy/s. Two materials with higher initial resistivities demonstrated significant REC, the highest resistivity of the two changing by more than a factor of thirty for a dose of 4.2 Gy/s.

34585 (DOE/ER–0592) **Review Committee report on the conceptual design of the Tokamak Physics Experiment.** US-DOE Office of Energy Research, Washington, DC (United States). Apr 1993. 198p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93018408. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the following topics on the conceptual design of the Tokamak Physics Experiment: Role and mission of TPX; overview of design; physics design assessment; engineering design assessment; evaluation of cost, schedule, and management plans; and, environment safety and health.

34586 (DOE/ER/54100–1-Vol.1) **Osiris and SOMBRERO inertial confinement fusion power plant designs: Volume 1, Executive summary and overview, Final report.** Meier, W.R.; Bieri, R.L.; Monsler, M.J. Schafer (W.J.) Associates, Inc., Wakefield, MA (United States). Mar 1992. 92p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-90ER54100. (WJSA–92-01-Vol.1). Order Number DE93019139. Source: OSTI; NTIS; INIS; GPO Dep.

Conceptual designs and assessments have been completed for two inertial fusion energy (IFE) electric power plants. The detailed designs and results of the assessment studies are presented in this report. Osiris is a heavy-ion-beam (HIB) driven power plant and SOMBRERO is a Krypton-Fluoride (KrF) laser-driven power plant. Both plants are sized for a net electric power of 1000 MWe.

34587 (DOE/ER/54100–1-Vol.2) **Osiris and SOMBRERO inertial confinement fusion power plant designs: Volume 2, Designs, assessments, and comparisons, Final report.** Meier, W.R.; Bieri, R.L.; Monsler, M.J. Schafer (W.J.) Associates, Inc., Wakefield, MA (United States). Mar 1992. 646p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-90ER54100. (WJSA–92-01-Vol.2). Order Number DE93019140. Source: OSTI; NTIS; INIS; GPO Dep.

The primary objective of the of the IFE Reactor Design Studies was to provide the Office of Fusion Energy with an evaluation of the potential of inertial fusion for electric power production. The term reactor studies is somewhat of a misnomer since these studies included the conceptual design and analysis of all aspects of the IFE power plants: the chambers, heat transport and power conversion systems, other balance of plant facilities, target systems (including the target production, injection, and tracking systems), and the two drivers. The scope of the IFE Reactor Design Studies was quite ambitious. The majority of our effort was spent on the conceptual design of two IFE electric power plants, one using an induction linac heavy ion beam (HIB) driver and the other using a Krypton Fluoride (KrF) laser driver. After the two point designs were developed, they were assessed in terms of their (1) environmental and safety aspects; (2) reliability, availability, and maintainability; (3) technical issues and technology development requirements; and (4) economics. Finally, we compared the design features and the results of the assessments for the two designs.

34588 (DOE/ER/54101–T1-Vol.1) **Inertial Fusion Energy reactor design studies: Prometheus-L, Prometheus-H: Volume 1, Final report.** Waganer, L.M.; Driemeyer, D.E.; Lee, V.D. McDonnell Douglas Corp., St. Louis, MO (United States); Canadian Fusion Fuels Technology Project, Mississauga, ON (Canada); KMS Fusion, Inc., Ann Arbor, MI (United States); TRW Space and Electronics Group, Redondo Beach, CA (United States); Ebasco Services, Inc., New York, NY (United States); SPAR Aerospace Ltd., Brampton, ON (Canada); California Univ., Los Angeles, CA (United States). Mar 1992. 97p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-90ER54101. (MDC–92E0008). Order Number DE93018648. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains a review of design studies for inertial confinement reactors. The first of three volumes briefly discusses the following: Introduction; Key objectives, requirements, and assumptions; Systems modeling and trade studies; Prometheus-L reactor plant design overview; Prometheus-H reactor plant design overview; Key technical issues and R&D requirements; Comparison of IFE designs; and study conclusions.

34589 (DOE/ER/54101–T1-Vol.2) **Inertial Fusion Energy reactor design studies: Prometheus-L, Prometheus-H: Volume 2, Final report.** Waganer, L.M.; Driemeyer, D.E.; Lee, V.D. McDonnell Douglas Corp., St. Louis, MO (United States). Aerospace Group; Canadian Fusion Fuels Technology Project, Mississauga, ON (Canada); KMS Fusion, Inc., Ann Arbor, MI (United States); TRW Space and Electronics Group, Redondo Beach, CA (United

States); Ebasco Services, Inc., New York, NY (United States); SPAR Aerospace Ltd., Brampton, ON (Canada); California Univ., Los Angeles, CA (United States). Mar 1992. 477p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-90ER54101. (MDC–92E0008). Order Number DE93018647. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains a review of design studies for Inertial Confinement reactor. This second of three volumes discussions is some detail the following: Objectives, requirements, and assumptions; rationale for design option selection; key technical issues and R&D requirements; and conceptual design selection and description.

34590 (DOE/ER/54101–T1-Vol.3) **Inertial Fusion Energy Reactor Design Studies: Prometheus-L, Prometheus-H: Volume 3, Final report.** Waganer, L.M. (McDonnell Douglas Corp., St. Louis, MO (United States). Aerospace Group); Driemeyer, D.E.; Lee, V.D. McDonnell Douglas Corp., St. Louis, MO (United States). Aerospace Group; Canadian Fusion Fuels Technology Project, Mississauga, ON (Canada); KMS Fusion, Inc., Ann Arbor, MI (United States); TRW Space and Electronics Group, Redondo Beach, CA (United States); Ebasco Services, Inc., New York, NY (United States); SPAR Aerospace Ltd., Brampton, ON (Canada); California Univ., Los Angeles, CA (United States). Mar 1992. 550p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-90ER54101. (MDC–92E0008). Order Number DE93018675. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains a review of design studies for inertial confinement reactor. This third of three three volumes discusses the following topics: Driver system definition; vacuum system; fuel processing systems (FPS); cavity design and analysis; heat transport and thermal energy conversion; balance of plant systems; remote maintenance systems; safety and environment; economics; and comparison of IFE designs.

34591 (DOE/FTR–93011430) **[Travel to Germany to attend meeting of the Technical Advisory Committee to the International Thermonuclear Experimental Reactor Council]: Foreign trip report, March 13–18, 1993.** Piet, S.J. EG and G Idaho, Inc., Idaho Falls, ID (United States). 2 Apr 1993. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93011430. Source: OSTI; NTIS (US Sales Only); GPO Dep.

I attended the March 15–17 TAC meeting at the Garching ITER Co-Center (Garching, Germany) on behalf of the US, as one of three designated US experts to advise TAC members. Three of my four primary objectives for the meeting were met, namely establish TAC support for safety objectives and goals, discourage TAC from prohibiting or dictating any material choices, and improve communication with both JCT and TAC personnel. The fourth objective, establishing TAC support for more aggressive (but higher potential performance) in-vessel material choices (ferritic steel?, titanium?, lithium, helium coolant) was not met to my satisfaction. There was limited TAC support for looking at such options but the TAC report shows preference for options (austenitic steel, water) that I believe offer lower performance and, indeed, very low chance of meeting ITER technology missions of 3 MW-yr/m^2 fluence, demonstrating technologies for DEMO, and demonstrating fusion safety and environmental potential.

34592 (DOE/FTR–93014001) **Travel to England for discussion on magnet design options for ITER: Foreign trip report, April 28–May 3, 1992.** Minervini, J.; Montgomery, B. Massachusetts Inst. of Tech., Cambridge, MA (United States). Plasma Fusion Center. 9 Jul 1992. 24p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER54110. Order Number DE93014001. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This meeting was held in response to a personal offer to P.H. Rebut made last December, to assist him in assessing magnet design options for ITER. P. H. Rebut presented the detail of his most recent proposed magnetic concepts for ITER, which differ somewhat from his previous proposals in the area of in-plane and out-of-plane structural support. Titus presented the results of his structural analysis of the Rebut concept previously available. Minervini present the results of TF and PF conductor analysis carried out by Joel Schultz and himself. Thome presented alternate concepts for fabrication. An extended discussion was held on general R&D needs.

34593 (DOE/FTR–93014806) **Meetings in Germany concerning TEXTOR and ITER: Foreign trip report, February 22–March 3, 1993.** McGrath, R.T. Sandia National Labs., Albuquerque, NM (United States). 4 Mar 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93014806. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Tasks to be executed by Sandia National Laboratories and by KFA - TEXTOR personnel, required to COMPlete the design and fabrication of new limiter tiles for ALT-II, were discussed. Work assignments and schedules were agreed upon. The meeting on Experimental Approach to the Physics of the High Recycling Diverter provided communication between the various home teams and the ITER Joint Central Team. Highlights of this meeting are briefly discussed below. The ASDEX/US DOE Workshop on Edge and Divertor Physics was an excellent exchange of information on divertor measurements and modeling. Highlights of this meeting are briefly discussed below.

34594 (DOE/FTR–93015302) **Travel to Germany and Austria regarding heavy ion fusion and radiation transport: Foreign trip report, January 28–February 15, 1992.** Mehlhorn, T.A. Sandia National Labs., Albuquerque, NM (United States). 27 Mar 1992. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93015302. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Enclosed is the trip report for Thomas A. Mehlhorn, Supervisor, Division 1272, dated February 24, 1990 - Trip Number 9108364. This trip included visits to the Max Planck Institute for Quantum Optics, Garching, Germany; the conference on Physics of High Energy Density in Matter, Hirschegg, Klein Walsertal, Austria; the Nuclear Research Center, Karlsruhe, Germany; and the Heavy Ion Research Center, Darmstadt, Germany. The trip was from January 28–February 15, 1992. The primary purpose was to present an invited paper at the Hirschegg Conference. The purpose of the other site visits was to obtain information on the generation and focusing of intense ion beams and the interaction of such ion beams with matter. A synopsis of each visit is included in the attached report.

34595 (DOE/FTR–93015952) **Travel to Japan to collaborate with the JT-60U diverter physics group on the tokamak experiment: Foreign trip report, March 17–April 3, 1993.** Watkins, J.G. Sandia National Labs., Albuquerque, NM (United States). 27 May 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93015952. Source: OSTI; NTIS (US Sales Only); GPO Dep.

J.Watkins, SNL, New Mexico and a member of the DIII-D diverter physics group, was invited to collaborate with the JT-60U divertor physics group and participate in an experiment at the Naka site. During the first day of the two week visit, a new record for the fusion triple product was achieved on JT-60U. The first ten days on site was spent learning and using the Fujitsu data display computer system to examine experimental data from the February 1993 divertor experiments. Measurements from many divertor diagnostics were studied. Experimental planning meetings were held during this period and an experiment to study the ELMing H mode took place on March 26. Preliminary analysis of the new data was performed. Tours of Naka site facilities were useful for evaluating technical capabilities of the tokamak, diagnostic, and neutral beam development programs. A short visit to NIFS allowed for orientation and evaluation of activities related to divertor physics and the Large Helical Device.

34596 (DOE/FTR–93016797) **Travel to Japan for Material Chemistry 1992 symposium and to collaborate on fusion reactor materials research: Foreign trip report, March 9–17, 1992.** Bastasz, R. Sandia National Labs., Livermore, CA (United States). 6 May 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DR00789. Order Number DE93016797. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report summarizes the Material Chemistry '92 Symposium held in Tsukuba, Japan, March 12–13, 1992, and describes some of the current research activities at the Japanese research institutes NRIM, NIRIM, and JAERI (Tokai, and Naka sites).

34597 (DOE/FTR–93017252) **Travel to England for meeting on ITER configuration: Foreign trip report, April 26–May 2, 1992.** Thome, R. Massachusetts Inst. of Tech., Cambridge, MA (United States). Plasma Fusion Center. 11 Jun 1992. 25p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER54110. Order Number DE93017252. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report briefly discusses the design philosophy for the ITER tokamak.

34598 (DOE/FTR–93017253) **Progress report of collaborative efforts at JET and PBX-M: Foreign trip report, August 30, 1991–February 20, 1992.** Jones, S. Massachusetts Inst. of Tech., Cambridge, MA (United States). Plasma Fusion Center. 11 Jun 1992. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-91ER54109. Order Number DE93017253. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Since joining MIT as a postdoctoral follow last JUIY, Stephen Jones has participated In research efforts at MIT, JET, and Princeton. The first period, at MIT, lasted five weeks and consisted of helping MIT write the VTF-D proposal, and. helping Jay Kesner initiate LHCD simulations of PBX-M using his now code. The second period, at JET, lasted 6 months and centered on two projects: The first project was to help setup MIT's collaborative efforts with the ECE ballooning mode diagnostic, and the second project was to initiate LHCD simulations by using the Bonoli code on JET's well-diagnosed plasma. The third, and current period of two weeks, has focused on helping the POX-M team with the now hard X-ray imaging diagnostic. This effort, and others, will continue at Princeton for the next 18 months. This report will further detail results of work done at JET, and intended work at Princeton.

34599 (DOE/FTR–93019138) **Travel to Germany as a safety representative of the Joint Central Team (JCT) of the International Thermonuclear Experimental Reactor (ITER): Foreign trip report, July 10–17, 1993.** Piet, S.J. EG and G Idaho, Inc., Idaho Falls, ID (United States). 4 Aug 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93019138. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report covers travel to Garching, Germany as a safety representative of the Joint Central Team (JCT) of the International Thermonuclear Experimental Reactor (ITER). W. Gulden, acting for the European Community (EC) Home Team (HT), arranged an EC meeting on Tuesday, July 13, of those EC countries primarily interested in hosting ITER (France, Sweden, Germany) to discuss the safety level and licensing implications of the current ITER design movement toward using liquid metals. The EC HT Leader, R. Toschi, asked for a representative of the ITER JCT to explain the ITER safety approach and provide safety information.

34600 (EGG-FSP–9971) **HYLIFE-II tritium management system.** Longhurst, G.R.; Dolan, T.J. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jun 1993. 84p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Order Number DE93019025. Source: OSTI; NTIS; INIS; GPO Dep.

The tritium management system performs seven functions: (1) tritium gas removal from the blast chamber, (2) tritium removal from the Flibe, (3) tritium removal from helium sweep gas, (4) tritium removal from room air, (5) hydrogen isotope separation, (6) release of non-hazardous gases through the stack, (7) fixation and disposal of hazardous effluents. About 2 TBq/s (5 MCi/day) of tritium is bred in the Flibe (Li_2BeF_4) molten salt coolant by neutron absorption. Tritium removal is accomplished by a two-stage vacuum disengager in each of three steam generator loops. Each stage consists of a spray of 0.4 mm diameter, hot Flibe droplets into a vacuum chamber 4 m in diameter and 7 m tall. As droplets fall downward into the vacuum, most of the tritium diffuses out and is pumped away. A fraction $\Phi \approx 10^{-5}$ of the tritium remains in the Flibe as it leaves the second stage of the vacuum disengager, and about 24% of the remaining tritium penetrates through the steam generator tubes, per pass, so the net leakage into the steam system is about 4.7 MBq/s (11 Ci/day). The required Flibe pumping power for the vacuum disengager system is 6.6 MW. With Flibe primary coolant and a vacuum disengager, an intermediate coolant loop is not needed to prevent tritium from leaking into the steam system. An experiment is needed to demonstrate vacuum disengager operation with Flibe. A secondary containment shell with helium sweep gas captures the tritium permeating out of the Flibe ducts, limiting leaks there to about 1 Ci/day. The tritium inventory in the reactor is about 190 g, residing mostly in the large Flibe recirculation duct walls. The total cost of the tritium management system is 92 M$, of which the vacuum disengagers cost = 56%, the blast chamber vacuum system = 15%, the cryogenic plant = 9%, the emergency air cleanup and waste treatment systems each = 6%, the protium removal system = 3%, and the fuel storage system and inert gas system each = 2%.

34601 (ENEA-RT-INN–92-16) **Chemical study of Li_2O Al_2O_3 phases: Preparation, acid dissolution and characterization by infrared analysis.** Zucchi, B. (ENEA, Casaccia (Italy). Area Energia e Innovazione); Zappa, G. Mar 1993. 22p. (RT/INN–92-16). Order Number DE93522934. Source: OSTI; NTIS (US Sales Only).

This paper reports on a preliminary study oriented to develop appropriate methodologies for the chemical characterization of gamma-$LiAlO_2$, a candidate for solid tritium breeders. Several phases of the Li_2O. Al_2O_3 system were synthesized for analytical purposes. Here the preparation methods are briefly described. Tests were conducted on: acid dissolution of Li-2O, Li-3AlO_3, alpha/beta-Li_5AlO_4, alpha/beta/gamma-$LiAlO_2$, ordered-$LiAl_5O_8$ and alpha/gamma-Al_2O_3, with HCl, H_3PO_4 and H_3PO_4-H_2SO_4, applying both open vessel digestion and microwave oven heating. All the Li-Al-O compounds examined were found to be soluble in H_3PO_4: H_2SO_4 (1:1) in the microwave oven. The different methodologies employed to dissolve the species are compared and the IR patterns of pure Li-Al-O compounds are also reported.

34602 (ENEA-RTI-NUCL-FUS–92-01) **ITER Driver Blanket, EC design.** Simbolotti, G. (ENEA, Frascati (Italy). Area Nucleare); Fabrizi, F.; Ferrari, M. 1992. 393p. Contract 88-184. Order Number DE93523003. Source: OSTI; NTIS (US Sales Only).

The International Thermonuclear Experimental Reactor (ITER) is a next generation tokamak the design of which is in progress under the auspices of the IAEA (International Atomic Energy Agency), with the participation of European Community, Japan, Soviet Union and United States of America. The ITER objective is the demonstration of the scientific and technological feasibility of a nuclear fusion via a Deuterium-Tritium (D-T) reaction. Within the framework of the ITER Conceptual Design Activities (CDA, 1988-1990), a conceptual design of the ITER Driver Blanket was carried out by the ENEA (Italian Agency for Energy, New Technologies and the Environment) Fusion Dept., in collaboration with ANSALDO SpA and SRS srl. A non nuclear experimental program is presently in progress aiming at testing the thermal-hydraulics and thermomechanics behaviour of a medium-scale representative blanket mock-up. The EC design was developed on the basis of 'given' design specifications defined by the ITER Team at the beginning of the CDA. Some of these specifications are presently being revised on the basis of results and critical issues found out during the CDA. Accordingly, the EC design will probably be modified and improved during the EDA. The status of the design at the end of CDA is reported in this paper.

34603 (ENEA-RT-NUCL–92-24) **High-speed repetitive pellet injector prototype for magnetic confinement fusion devices.** Frattolillo, A. (Associazione EURATOM-ENEA sulla fusione, Frascati (Italy)); Gasparotto, M.; Scaramuzzi, F. 1992. 6p. Order Number DE93522980. Source: OSTI; NTIS (US Sales Only).

The fuelling requirements of future magnetic confinement devices for controlled thermonuclear research (e. g., ITER) indicate a need to upgrade the performance (speed, mass, number of pellets, etc.) of present-day pellet injectors. An experiment in collaboration between ENEA (Italian Agency for Energy, New Technologies and the Environment) Frascati and ORNL has been started, with the objective of demonstrating a repeating pellet injector capable of delivering D_2 ice pellets at rates around 1 Hz and with speeds in the range 1 -: - 3 km/s, using an existing ORNL extruder and a Frascati two-stage gun. This activity will be carried out in the framework of a collaborative agreement between U.S. D.O.E. and EURATOM-ENEA Association. The result of numerical simulations and preliminary tests of the two devices, which will be matched together in Oak Ridge, are described. The results of a study in

course at CNPM-CNR (under ENEA contract) about the possibility of minimizing piston wear, are also reported.

34604 (ETDE-IT–93-207) **Density limit and confinement in FTU Ohmic plasma.** Alladio, F. (Associazione EURATOM-ENEA sulla Fusione, Frascati (Italy)); Apicella, M.L.; Apruzzese, G. 1992. 17p. (CONF-920913–33: 14. international conference on plasma physics and controlled nuclear fusion research, Wurzburg (Germany), 30 Sep - 7 oct 1992). Order Number DE93522959. Source: OSTI; NTIS (US Sales Only).

This paper describes the study of ohmic plasma in the high field tokamak FTU (Frascati Tokamak Upgrade). The role of light and metallic impurities is discussed and their influence on the density limit of the device is documented. Results on plasma fuelling are reported, including the first experiments with pellet injection. The measured radial flow velocity of the plasma is found to be in good agreement with the prediction of extended neoclassical theory. The ohmic confinement is documented for normal and detached discharges.

34605 (ETDE-IT–93-212) **ABAQUS application for a thermonuclear plasma facing component.** Pizzuto, A. (Associazione EURATOM-ENEA sulla Fusione, Frascati (Italy)); Riccardi, B. 1993. 12p. Order Number DE93522977. Source: OSTI; NTIS (US Sales Only).

The Frascati Tokamak Upgrade (FTU), now operating in the ohmic phase with a localized plasma facing component (poloidal limiter), will be supplied with a continuous one (toroidal limiter) to withstand the large heat flux expected during the 8 MW, 8 GHz LH radio frequency heating experimental phase. The FTU toroidal limiter must be installed in the existing vacuum chamber and the solution studied consists of 12 sectors, each 380 x 330 mm. To minimize eddy current effects and to limit thermal mismatches in each sector, twelve Inconel tiles are fixed on a stainless steel tree supporting structure. Since the mechanical behaviour of the limiter is crucial in assessing its reliability, an extensive three dimensional finite elements analysis was performed modelling a quarter of a sector using 20 node brick elements. In particular, a non-linear transient thermal analysis was made under a square wave shaped heat flux history. Then, a fully non-linear (both geometric and material) mechanical analysis was performed to investigate the deformed configuration of the tile + support component and the stress level in the tiles. After that, a ratcheting analysis, based on a simplified model, was made to understand the selected material mechanical behaviour under a sufficient number of cycles. The main results obtained with the analysis are illustrated in the paper.

34606 (ETDE-IT–93-213) **Injection of solid deuterium pellets into Frascati Tokamak Upgrade (FTU).** Alladio, F. (Associazione EURATOM-ENEA sulla Fusione, Frascati (Italy)); Buratti, P.; Frattolillo, A.; Grolli, M.; Micozzi, P.; Migliori, S.; Tononi, G.; Zerbini, M.; Scaramuzzi, F.; Snipes, J.A. 1989. 5p. Order Number DE93522981. Source: OSTI; NTIS (US Sales Only).

A high-speed D_2 single-pellet injector (SPIN) has been in operation on the Frascati Tokamak Upgrade (FTU) machine since 15 July, 1992. This paper compares the injector performance with simulation codes and reports the experimental results of pellet-plasma interactions in ohmic discharges. The results of cryogenic experiments carried out with the high-speed multi-shot pellet injector for FTU are also presented. In addition, work is being performed on the preliminary development of injectors that meet the requirements of tokamak machines having larger dimensions (or ITER/NET-type devices).

34607 (INIS-RU–353, pp. 40-42) **On the account of mixing effect in numerical simulation of compression of laser shell targets.** Zakharenkov, Yu.A.; Lebo, I.G.; Shpatakovskaya, G.V. AN SSSR, Moscow (Russian Federation). Fizicheskij Inst. 1991. (In Russian). In *Short communications on physics. Experimental and theoretical physics. No. 9.* 48p. Order Number DE94600071. Source: OSTI; NTIS (US Sales Only); INIS.

The effect of mixing during thermonuclear laser target heating and compression was studied. A simple model for the effect accounting in one-dimensional calculation is suggested. The comparison of the calculated results with the data on mass spectrometry of neutral atoms in experiments in the VULKAN facility, was made. The calculation was realized for the target consisting of a glass shell filled with the DT gas at the Nd laser energy of 300J on the second harmonics (0.53 μm) and the Gaussian pulse shape. It is shown that the mixing of the shell material to the DT fuel results not only in the neutron yield decrease and the neutral component spectra change in divergent plasma, but also in change of the target compressed core luminosity.

34608 (LA–12545-MS) **Beryllium processing technology review for applications in plasma-facing components.** Castro, R.G.; Jacobson, L.A.; Stanek, P.W. Los Alamos National Lab., NM (United States). Jul 1993. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93018396. Source: OSTI; NTIS; INIS; GPO Dep.

Materials research and development activities for the International Thermonuclear Experimental Reactor (ITER), i.e., the next generation fusion reactor, are investigating beryllium as the first-wall containment material for the reactor. Important in the selection of beryllium is the ability to process, fabricate and repair beryllium first-wall components using existing technologies. Two issues that will need to be addressed during the engineering design activity will be the bonding of beryllium tiles in high-heat-flux areas of the reactor, and the in situ repair of damaged beryllium tiles. The following review summarizes the current technology associated with welding and joining of beryllium to itself and other materials, and the state-of-the-art in plasma-spray technology as an in situ repair technique for damaged beryllium tiles. In addition, a review of the current status of beryllium technology in the former Soviet Union is also included.

34609 (LA-SUB–93-234) **Computational support and model development for edge-plasma and energy transport simulations: Progress report, 1989.** Prinja, A.K. (New Mexico Univ., Albuquerque, NM (United States). Dept. of Chemical and Nuclear Engineering); Knoll, D. Los Alamos National Lab., NM (United States); New Mexico Univ., Albuquerque, NM (United States). Dept. of Chemical and Nuclear Engineering. [1989]. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93018272. Source: OSTI; NTIS; INIS; GPO Dep.

The focus of the work was on two dimensional modelling of scrape-off layer (SOL) and divertor plasmas in the JET tokamak, with the objective of guiding the ITER divertor design, particularly in the area of fundamental edge plasma data. Additionally, a diffusion model for neutral atom transport in edge plasmas was developed and tested.

34610 (LA-UR–93-420) **Development of a non-LTE spectral post-processor for dense plasma simulations with application to spectroscopic diagnostics in spherical implosions at Nova.** Pollak, G.D. (Los Alamos National Lab., NM (United States)); Delamater, N.D.; Nash, J.K.; Hammel, B.A. Los Alamos National Lab., NM (United States). [1993]. 27p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-931141–1: Radiative properties of hot dense matter, Santa Barbara, CA (United States), 2-5 Nov 1993). Order Number DE93007327. Source: OSTI; NTIS; GPO Dep.

A new non-LTE spectroscopy post-processing package is described. The package processes dump files from 1 or 2-dimensional radiation-hydrodynamics code simulations. Given the grid motion, temperatures, and ion densities contained in the dump files, as well as data from an arbitrarily detailed atomic model, the post-processor calculates internally consistent detailed frequency dependent opacities and radiation fields. The radiation transport equation is solved in the S_n approximation using lambda iteration. Sub-cycling is used to achieve a more accurate solution to both the kinetics and radiation field calculations. Line broadening is included using Voigt widths based on the atomic rate coefficients, and Stark widths are included for K-shell spectra. The Sobolev escape factor approximation is available as an option. This post-processing package has been used to analyze spectra obtained recently at Nova with Ar doped deuterium filled capsules. The dopant was designed to be primarily a density diagnostic but can also be used for temperature diagnosis as well. We have run this post-processor with a wide array of atomic models for Argon,

ranging from one containing only singly excited levels for the Hydrogenic, He-like, and Li-like sequences, to one containing a large number of doubly- and triply-excited levels in these sequences. We show a strong dependence of the degree of agreement between simulation and experiment on the model complexity with only the most complex model in close agreement.

34611 (LA-UR–93-2700) **Parametric analysis of the ARIES-III D-^{3}He tokamak reactor.** Bathke, C.G. (Los Alamos National Lab., NM (United States)); Werley, K.A.; Miller, R.L.; Krakowski, R.A.; Santarius, J.F. Los Alamos National Lab., NM (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-9307125–1: ^{3}He and fusion power symposium, Madison, WI (United States), 18-22 Jul 1993). Order Number DE93018293. Source: OSTI; NTIS; INIS; GPO Dep.

The multi-institutional ARIES study has completed a series of conceptual designs of tokamak fusion reactors that varies the assumed advances in technology and physics. The ARIES-III design uses a D- ^{3}He fuel cycle and requires significant advances in physics to enhance economic attractiveness. The optimal design was characterized through systems analysis for eventual conceptual engineering design. Results from the systems analysis are summarized, and a comparison with the other ARIES designs is included.

34612 (LBL–33284) **Electrostatic quadrupoles for heavy-ion fusion.** Seidl, P.; Faltens, A. Lawrence Berkeley Lab., CA (United States). May 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (HIFAN–569;CONF-930511–340: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018711. Source: OSTI; NTIS; INIS; GPO Dep.

Voltage-holding data for three quadrupole electrode sizes and inter-electrode spacings are reported. The dependence of the breakdown voltage on system size and its influence on the optimum quadrupole size for beam transport in a multiple beam array are discussed.

34613 (LBL–33287) **Induction accelerator development for heavy ion fusion.** Reginato, L.L. Lawrence Berkeley Lab., CA (United States). May 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (HIFAN–572;CONF-930511–341: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018698. Source: OSTI; NTIS; INIS; GPO Dep.

For approximately a decade, the Heavy Ion Fusion Accelerator Research (HIFAR) group at LBL has been exploring the use of induction accelerators with multiple beams as the driver for inertial fusion targets. Scaled experiments have investigated the transport of space charge dominated beams (SBTE), and the current amplification and transverse emittance control in induction linacs (MBE-4) with very encouraging results. In order to study many of the beam manipulations required by a driver and to further develop economically competitive technology, a proposal has been made in partnership with LLNL to build a 10 MeV accelerator and to conduct a series of experiments collectively called the Induction Linac System Experiments (ILSE). The major components critical to the ILSE accelerator are currently under development. We have constructed a full scale induction module and we have tested a number of amorphous magnetic materials developed by Allied Signal to establish an overall optimal design. The electric and magnetic quadrupoles critical to the transport and focusing of heavy ion beams are also under development The hardware is intended to be economically competitive for a driver without sacrificing any of the physics or performance requirements. This paper will concentrate on the recent developments and tests of the major components required by the ILSE accelerator.

34614 (LBL–33289) **Heavy Ion Fusion Injector Program.** Yu, S.; Eylon, S.; Chupp, W.W. Lawrence Berkeley Lab., CA (United States). May 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (HIFAN–574;CONF-930511–335: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018706. Source: OSTI; NTIS; INIS; GPO Dep.

A program is underway to construct a 2 MV, 800 mA, K^+ injector for heavy ion fusion. The Electrostatic Quadrupole (ESQ) injector configuration consists of a zeolite source, a diode of up to 1 MV, together with several electrostatic quadrupole units to simultaneously focus and accelerate the beam to 2 MV. The key issues of source technology, high voltage breakdown, beam aberrations, and transient effects will be discussed. Results from ongoing experiments and simulations will be presented.

34615 (LBL–33804) **Longitudinal instability in heavy-ion-fusion induction linacs.** Lee, E.P. Lawrence Berkeley Lab., CA (United States). May 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. (HIFAN–583;CONF-9305136–10: International symposium on heavy ion fusion, Frascati (Italy), 25-28 May 1993). Order Number DE93019242. Source: OSTI; NTIS; INIS; GPO Dep.

A induction linac accelerating a high-current pulse of heavy ions at subrelativistic velocities is predicted to exhibit unstable growth of current fluctuations. An overview is given of the mode character, estimates of growth rates, and their application to an IFE driver. The present and projected effort to understand and ameliorate the instability is described. This includes particle-in-cell simulations, calculation and measurements of impedance, and design of feedback controls.

34616 (ORNL/FTR–4630) **Travel to Italy for conference on Fusion Reactor Materials: Foreign trip report, April 26–May 2, 1993.** Davis, J.W. Oak Ridge National Lab., TN (United States). 27 May 1993. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93015639. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The second meeting of the Organizing Committee covered selection of both oral and poster papers to be presented at the conference as well as reviewing the facility arrangements, program schedule, and publication proceedings. Following the paper review, a tour of the meeting site was made to review hotel accommodations as well as meeting facilities. Participating in this review were roughly 20 scientists representing the European Communities, the Russian Federation, and the United States. There was no Japanese representation.

34617 (PPPL–2912) **Modeling of ultra-high recycling divertors with the PLANET code.** Petravic, M. Princeton Univ., NJ (United States). Plasma Physics Lab. Jul 1993. 16p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03073. Order Number DE93018389. Source: OSTI; NTIS; INIS; GPO Dep.

The handling of power carried by the charged particles into the scrape-off layer of a tokamak reactor remains a major obstacle for its continuous and reliable operation. Ways of reducing this power through radiation have been studied numerically using fluid models for both the plasma and neutral gas. A new model for the combined plasma and neutral gas 2-D transport capable of simultaneously representing regions of fully-ionized plasma, partially ionized plasma, and pure neutral gas has been assembled and implemented in the PLANET code. Divertor plasma temperatures of just below 1 eV have been achieved in a pure hydrogen plasma, resulting in an ionization-free region together with ionization and recombination fronts detached from the material walls. In this regime energy reaches the walls almost exclusively in the form of radiation which, in principle, solves the divertor heat load problems.

34618 (UCRL-CR–112610) **Pulsed power supply for Nova Upgrade: Final report, August 1, 1991 to March 31, 1992.** Bacon, J.L. (Univ. of Texas, Austin, TX (US). Center for Electromechanics); Kajs, J.P.; Walls, A.; Weldon, W.F.; Zowarka, R.C. Lawrence Livermore National Lab., CA (United States); Texas Univ., Austin, TX (United States). Center for Electromechanics. 1992. 106p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93019626. Source: OSTI; NTIS; INIS; GPO Dep.

This report describes work carried out at the Center for Electromechanics at The University of Texas at Austin (CEM-UT). A baseline design of the Nova Upgrade has been completed by Lawrence Livermore National Laboratory. The Nova Upgrade is an 18 beamline Nd: glass laser design utilizing fully relayed 4x4 30

cm aperture segmented optical components. The laser thus consists of 288 independent beamlets nominally producing 1.5 to 2.0 MJ of 0.35 μm light in a 3 to 5 ns pulse. The laser design is extremely flexible and will allow a wide range of pulses to irradiate ICF targets. This facility will demonstrate ignition/gain and the scientific feasibility of ICF for energy and defense applications. The pulsed power requirements for the Nova Upgrade are given. CEM-UT was contracted to study and develop a design for a homopolar generator/inductor (HPG/inductor) opening switch system which would satisfy the pulsed power supply requirements of the Nova Upgrade. The Nd:glass laser amplifiers used in the Nova Upgrade will be powered by light from xenon flashlamps. The pulsed power supply for the Nova Upgrade powers the xenon flashlamps. This design and study was for a power supply to drive flashlamps.

34619 (UCRL-ID–113266) **Improved HYLIFE-II heat transport system and steam power plant: Impact on performance and cost of electricity: Final report for fiscal year 1992.** Hoffman, M.A. (Univ. of California, Davis, CA (US). Dept. of Mechanical, Aeronautical and Materials Engineering); Lee, Ying T. Lawrence Livermore National Lab., CA (United States). Dec 1992. 109p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93017945. Source: OSTI; NTIS; INIS; GPO Dep.

The HYLIFE-II conceptual design has evolved and improved continually over the past four years to its present form. This paper describes the latest FY92 versions, Reference Case H1 (nominally 1 GWe net output) and the Enhanced Case HE (nominally 2 GWe net output), which take advantage of improvements in the tritium management system to eliminate the intermediate loop and the intermediate heat exchangers (IHX's). The improvements in the heat transport system and the steam power plant are described and the resulting cost reductions are evaluated. The new estimated cost of electricity (in 1990 dollars) is 6.6 ¢/kWh for Reference Case H1 and 4.7 ¢/kWh for the Enhanced Case.

34620 (UCRL-JC–112167) **Hydrodynamic instability modeling for ICF.** Haan, S.W. Lawrence Livermore National Lab., CA (United States). 31 Mar 1993. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9303126–8: 4. international workshop on the physics of compressible turbulent mixing, Cambridge (United Kingdom), 29 Mar - 1 apr 1993). Order Number DE93018634. Source: OSTI; NTIS; GPO Dep.

The intent of this paper is to review how instability growth is modeled in ICF targets, and to identify the principal issues. Most of the material has been published previously, but is not familiar to a wide audience. Hydrodynamic instabilities are a key issue in ICF. Along with laser-plasma instabilities, they determine the regime in which ignition is possible. At higher laser energies, the same issues determine the achievable gain. Quantitative predictions are therefore of the utmost importance to planning the ICF program, as well as to understanding current Nova results. The key fact that underlies all this work is the stabilization of short wavelengths.

34621 (UCRL-JC–112344) **Simulation of transient effects in the heavy ion fusion injectors.** Chen, Yu-Jiuan; Hewett, D.W. Lawrence Livermore National Lab., CA (United States). 12 May 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930511–336: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018658. Source: OSTI; NTIS; GPO Dep.

We have used the 2-D PIC code, GYMNOS, to study the transient behaviors in the Heavy Ion Fusion (HIF) injectors. GYMNOS simulations accurately provide the steady state Child-Langmuir current and the beam transient behavior within a planar diode. The simulations of the LBL HIF ESAC injector experiments agree well with the experimental data and EGUN steady state results. Simulations of the nominal HIF injectors have revealed the need to design the accelerating electrodes carefully to control the ion beam current, particularly the ion loss at the end of the bunch as the extraction voltage is reduced.

34622 (UCRL-JC–112377) **Correction of longitudinal errors in accelerators for heavy-ion fusion.** Sharp, W.M. (Lawrence Livermore National Lab., CA (United States)); Callahan, D.A.; Barnard, J.J.; Langdon, A.B.; Fessenden, T.J. Lawrence Livermore National Lab., CA (United States). 10 Jun 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930511–337: International particle accelerator conference, Washington, DC (United States), 17-20 May 1993). Order Number DE93018656. Source: OSTI; NTIS; GPO Dep.

Longitudinal space-charge waves develop on heavy-ion inertial-fusion pulse from initial mismatches or from inappropriately timed or shaped accelerating voltages. Without correction, waves moving backward along the beam can grow due to the interaction with their resistively retarded image fields, eventually degrading the longitudinal emittance. A simple correction algorithm is presented here that uses a time-dependent axial electric field to reverse the direction of backward-moving waves. The image fields then damp these forward-moving waves. The method is demonstrated by fluid simulations of an idealized inertial-fusion driver, and practical problems in implementing the algorithm are discussed.

34623 (UCRL-JC–112762) **Thermo-hydraulic analysis of superconducting toroidal-field magnets for the Tokamak Physics Experiment.** Wong, R.L.; Zbasnik, J.P.; Hassenzahl, W.V. Lawrence Livermore National Lab., CA (United States). 9 Jul 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930703–12: International cryogenic engineering conference and international cryogenic materials conference, Albuquerque, NM (United States), 12-16 Jul 1993). Order Number DE93018096. Source: OSTI; NTIS; INIS; GPO Dep.

The superconducting magnets in Fusion Reactors are subjected to pulsed, nuclear, and resistive heating. The thermo-hydraulic response of the helium forced-flow cooled conductors to the various heat sources is critical to magnet design and performance. Recently developed computer codes allow accurate modeling of conductor response and have been used as an aid to design of the toroidal field (TF) magnets for the Tokamak Physics experiment (TPX). We present results of design studies that determine the trade-off between double- and single-pancake helium flow configurations, the minimum-temperature margin, and the stability against rapid heat input. The results guide the choice and design of the liquid helium refrigerator.

34624 (UCRL-JC–113033) **Radiative divertor modeling studies.** Rensink, M.E.; Allen, S.L.; Hill, D.N.; Kaiser, T.B.; Rognlien, T.D. Lawrence Livermore National Lab., CA (United States). 5 May 1993. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930720–18: 20. European conference on controlled fusion and plasma physics, Lisbon (Portugal), 26-30 Jul 1993). Order Number DE93018092. Source: OSTI; NTIS; INIS; GPO Dep.

A two-dimensional fluid code called UEDGE is used to simulate the edge plasma in tokamak divertors and to evaluate methods for reducing the heat load on divertor plates by radiating some of the power before it reaches the plates. UEDGE is a fully-implicit code being developed jointly by us, D. A. Knoll and R. B. Campbell. For these studies, UEDGE uses a banded matrix solver and a fixed-fraction impurity model. Work is presently underway with Knoll and Campbell to include a memory-efficient iterative solver and a model of impurity transport. Simulations of the proposed TPX device show that a few percent nitrogen concentration in the scrape-off layer can radiate up to 80% of the divertor power, thus reducing the peak heat flux and electron temperature at the divertor plate to acceptable values. A comparison of the neutral gas distribution from UEDGE with results from the DEGAS Monte Carlo neutrals code confirms the validity of our fluid neutrals model.

34625 (UCRL-JC–114531) **Design of a tunable 4-MW Free Electron Maser for heating fusion plasmas.** Caplan, M.; Kamin, G.; Shang, C.C.; Lindquist, W. Lawrence Livermore National Lab., CA (United States). Sep 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9309124–1: 18. annual international conference on infrared and millimeter waves, Colchester (United Kingdom), 6-10 Sep 1993). Order Number DE93017172. Source: OSTI; NTIS; INIS; GPO Dep.

There is an ongoing program at the FOM institute, The Netherlands, to develop a 1-MW, long-pulse, 200-Ghz Free Electron Maser (FEM) using a DC accelerator system with depressed collector. We present an extrapolation of this design to more than 4MW of output microwave power in order to reduce the cost per kW and increase the power per module in a plasma heating system.

34626 (WSRC-MS–93-091) **Overlay welding irradiated stainless steel.** Kanne, W.R.; Chandler, G.T.; Nelson, D.Z.; Franco-Ferreira, E.A. Westinghouse Savannah River Co., Aiken, SC (United States). [1993]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. (CONF-930928–1: 6. international conference on fusion reactor materials, Stresa (Italy), 27 Sep - 1 oct 1993). Order Number DE93018767. Source: OSTI; NTIS; INIS; GPO Dep.

An overlay technique developed for welding irradiated stainless steel may be important for repair or modification of fusion reactor materials. Helium, present due to n,α reactions, is known to cause cracking using conventional welding methods. Stainless steel impregnated with 3 to 220 appm helium by decay of tritium was used to develop a welding process that could be used for repair. The result was a gas metal arc weld overlay technique with low-heat input and low-penetration into the helium-containing material. Extensive metallurgical and mechanical testing of this technique demonstrated substantial reduction of helium embrittlement damage. The overlay technique was applied to irradiated 304 stainless steel containing 10 appm helium. Surface cracking, present in conventional welds made on the same steel at lower helium concentrations, was eliminated. Underbead cracking, although greater than for tritium charged and aged material, was minimal compared to conventional welding methods.

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34627 (BNL–52300-Rev.10/92) **The future is yours–Get ready! Career options in scientific and technical fields: Revision.** Brookhaven National Lab., Upton, NY (United States). Oct 1992. 50p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH00016. Order Number DE93017985. Source: OSTI; NTIS; GPO Dep.

This 50 page brochure was developed by Brookhaven National Laboratory to encourage high school students to begin considering careers in the scientific and technical fields. The topics of the brochure include career selection, career options, a review of training required for each occupation, a collection of profiles of BNL employees describing how they chose and prepared for their careers, a description of BNL educational programs for high school students, and profiles of some of the students participating in these programs.

34628 (LA-SUB–93-249) **Science and Technology Alliance work schedule FY 1992: Annual report.** Los Alamos National Lab., NM (United States); New Mexico Highlands Univ., Las Vegas, NM (United States). [1992]. 39p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93019294. Source: OSTI; NTIS; GPO Dep.

This report includes operational and financial planning information for fiscal year 1992 for New Mexico Highlands University.

34629 (LBL-PUB–725) **LBL/JSU/AGMUS science consortium annual report, FY 1991–1992.** Lawrence Berkeley Lab., CA (United States). 1992. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC03-76SF00098. Order Number DE93019265. Source: OSTI; NTIS; GPO Dep.

In 1983, a formal Memorandum of Understanding joined the Ana G. Mendez University System (AGMUS), Jackson State University (JSU), and the Lawrence Berkeley Laboratory (LBL) in a consortium designed to advance the science and technology programs of JSU and AGMUS. This is the first such collaboration between a Hispanic university system, a historically Black university, and a national laboratory. The goals of this alliance are basic and direct: to develop and effect a long-term, comprehensive program that will enable the campuses of AGMUS and JSU to provide a broad, high-quality offering in the natural and computer sciences, to increase the number of minority students entering these fields, and to contribute to scientific knowledge and the federal government's science mission through research. This report documents the progress toward these goals and includes individual success stories. The LBL/JSU/AGMUS Science Consortium has developed plans for utilizing its program successes to help other institutions to adopt or adapt those elements of the model that have produced the greatest results. Within the five-year plan formulated in 1990 are eight major components, each with defining elements and goals. These elements have become the components of the Science Consortium's current plan for expansion and propagation.

34630 (UCRL-ID–114953) **INSENS classification algorithm report.** Hernandez, J.E.; Frerking, C.J.; Myers, D.W. Lawrence Livermore National Lab., CA (United States). 28 Jul 1993. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93019619. Source: OSTI; NTIS; GPO Dep.

This report describes a new algorithm developed for the Imigration and Naturalization Service (INS) in support of the INSENS project for classifying vehicles and pedestrians using seismic data. This algorithm is less sensitive to nuisance alarms due to environmental events than the previous algorithm. Furthermore, the algorithm is simple enough that it can be implemented in the 8-bit microprocessor used in the INSENS system.

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Refer also to citation(s) 32563, 32575, 33366, 33388, 33470, 34059, 34414, 34519, 34706

34631 (DOE/FTR–93015323) **Travel to Italy to plan agenda of International Electrotechnical Commission/Technical Committee 82, Solar Photovoltaic Energy Systems meeting: Foreign trip report, May 2–8, 1993.** Klein, R.J. National Renewable Energy Lab., Golden, CO (United States). 9 Jun 1993. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-83CH10093. Order Number DE93015323. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details the support provided to the Secretary and necessary technical support personnel for the United States held Secretariat during the IEC/TC82 meeting and its working groups. Both the Assistant Secretary, Mr. Chalmers, and the author met with with Professor Sekine, Chairman of TC82, to discuss each agenda item and plan for a smooth meeting. Several policy issues were discussed and agreed upon.

34632 (DOE/PE/17060–T1) **Record of principal work activities/deliverables: Final technical report, September 28, 1984–September 27, 1989.** Arinc Research Corp., Annapolis, MD (United States). Sep 1989. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC01-84PE17060. Order Number DE93018605. Source: OSTI; NTIS; INIS; GPO Dep.

Over the five year period of performance, thirteen task assignments were issued by the DOE to ARINC Research. During the two year base period seven tasks were assigned. Two task assignments were issued for each of the three consecutive one year option periods. Associated with all task assignments were multiple subtasks, some of which required significant effort. These subtasks are appropriately cited in this report under their respective task assignments as principal work activities or deliverables. The technical and management support provided to the DOE under this contract focused on two general areas: (1) appraisal activities and (2) non-appraisal activities. Support to appraisals included planning, document review, developing lines-of-inquiry, interviewing, data collection, report writing, and follow-up. Such work was executed both on-site at the DOE facility under review and off-site. Non-appraisal support was varied and included such areas as document review, data base development, technical assessments. statistical analysis, policy analysis, reliability engineering, and workshop and conference planning and execution.

34633 (EGG-M–93052) **Configuration management of DOE facilities – lessons learned.** Klingler, C.M.; Smith, P.R. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1993]. 15p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. (CONF-9308110–1: 17. annual symposium of the

Nuclear Information and Records Management Association, Augusta, GA (United States), 29 Aug - 2 sep 1993). Order Number DE93018998. Source: OSTI; NTIS; GPO Dep.

Configuration management (CM) is an integrated management process to ensure that facilities' physical and functional characteristics are maintained in conformance with the facilities' authorization basis and that modifications, maintenance, and operating processes are consistent with the conditions prescribed by the design basis. The Department of Energy (DOE) completed a feasibility study of DOE Nuclear facilities in the area of Configuration Management. The CM review was associated with their effort to review and improve all aspects of DOE Facility and operations safety. Based upon these reviews and discussions with selected utilities and DOE Site Contractors, a recommendation to issue a DOE Order was given resulting in DOE 5480.CM, "Operational Configuration Management." DOE prepared a draft order and issued it for comment to the other DOE Field Offices, and some selected Maintenance and Operations (M&O) Contractors. Another DOE Headquarters group is preparing a CM Order DOE 663, Configuration Management for Non-Nuclear Facilities. EG&G Idaho used the DOE Orders on several nuclear facilities and has some lessons learned they desire to share with the DOE nuclear and non-nuclear industry. This session will discuss an overall CM Program and give lessons learned when available.

34634 (INIS-mf–13690) **Statens Straalevern.** Statens Straalevern, Oesteraas (Norway). Jun 1993. 12p. (In Norwegian). Order Number DE94600345. Source: OSTI; NTIS; INIS.

This booklet describes the functions and responsibilities of the Norwegian Radiation Protection Authority which was established at the commencement of 1993. The former National Institute of Radiation Protection and Nuclear Energy Safety Authority have merged into the new organization which is attached to the Ministry of Health and Social Affairs.

34635 (LA-UR–93-913) **Preparing organizations to qualify/certify training staff members: A case study with implications for continuing professional education.** Jannotta, M.; Houghton, K. Los Alamos National Lab., NM (United States). Nov 1992. 36p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-931066–1: American Association of Adult Continuing Education (AAACE) conference, Dallas, TX (United States), Oct 1993). Order Number DE93010706. Source: OSTI; NTIS; GPO Dep.

In keeping with LANL policy to apply the principles of performance-based training (PBT), the Laboratory Training Office conducted a job/task survey prior to developing the procedure for training staff qualification. Over one hundred Laboratory employees whose roles include training responded. While there is a significant amount of training conducted at the Laboratory, findings indicate a need for (a) increased, specific documentation of training and related activities; (b) greater understanding and application of PBT by laboratory training staff; (c) isolating and responding to the reasons training staff are reluctant to attend Laboratory-sponsored PBT and OJT training, even when the need for such training was recognized by respondents. Most training staff members have roles other than the training role. Nonetheless they perform several training functions. About half the training staff do not provide training which addresses PBT standards, especially in the areas of analysis (which directly impacts resource requirements), evaluation (which directly impacts quality), and documentation (which directly affects liability).

34636 (PNL-MA–599-Vol.1) **Analytical Chemistry Laboratory (ACL) procedure compendium: Volume 1, Administrative.** Pacific Northwest Lab., Richland, WA (United States). Jun 1992. 64p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93019189. Source: OSTI; NTIS; INIS; GPO Dep.

Covered are: analytical laboratory operations (ALO) sample receipt and control, ALO data report/package preparation review and control, single shell tank (PST) project sample tracking system, sample receiving, analytical balances, duties and responsibilities of sample custodian, sample refrigerator temperature monitoring, security, assignment of staff responsibilities, sample storage, data reporting, and general requirements for glassware.

34637 (PNL-SA–22371) **Quality, management, and the interplay of self-assessment, process assessments, and performance-based observations.** Willett, D.J. Pacific Northwest Lab., Richland, WA (United States). Apr 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. (CONF-930538–4: 4. conduct of operations workshop: the key to continued success, Tampa, FL (United States), 4-6 May 1993). Order Number DE93018787. Source: OSTI; NTIS; GPO Dep.

In this document, the author presents his observations on the topic of quality assurance (QA). Traditionally the focus of quality management has been on QA organizations, manuals, procedures, audits, and assessments; quality was measured by the degree of conformance to specifications or standards. Today quality is defined as satisfying user needs and is measured by user satisfaction. The author proposes that quality is the responsibility of line organizations and staff and not the responsibility of the QA group. This work outlines an effective Conduct of Operations program. The author concludes his observations with a discussion of how quality is analogous to leadership.

34638 (RISO-R–682(EN)) **Materials Department annual report for 1992.** Horsewell, A.; Hansen, N. (eds.). Risoe National Lab., Roskilde (Denmark). Materials Dept. Jun 1993. 62p. Order Number DE94600346. Source: OSTI; NTIS; INIS.

Selected activities of the Materials Department at Risoe National Laboratory during 1992 are described. The work is presented in three chapters: Materials Science, Materials Engineering and Materials Technology. A surveys is given of the Department's participation in international collaboration and of its activities within education and training. Furthermore, the main figures outlining the funding and expenditure of the Department are given. Lists of staff members, visiting scientists, publications, lectures and poster presentations are included. (au) (176 refs.).

34639 (SAND–93-1444C) **Improving quality in a matrix management environment by documenting key processes using project management tools.** Furaus, J.P.; Williams, J.L.; McKeever, P.S.; Figueroa-McInteer, C.; Glidewell, D.D. Sandia National Labs., Albuquerque, NM (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9310104–1: 24. Project Management Institute annual seminar, San Diego, CA (United States), 1-7 Oct 1993). Order Number DE93016497. Source: OSTI; NTIS; GPO Dep.

The Facilities Organization at Sandia has undergone many changes in the past five years. Management has made a commitment to improve the matrix management system and apply quality principles to the organization. This management commitment enabled Facilities to use project management tools for defining and documenting Facilities key processes. The resulting documentation included implementation plans for defining participant roles and responsibilities, identifying critical success factors, measuring performance, and ensuring continuous improvement. All of this resulted in benefits that demonstrate the value of project management and show how project management and quality are intertwined.

34640 (SSI–93-08) **Project Radiation Protection - East: Status report.** Bennerstedt, T. (Tekno Telje (Sweden)); Snihs, J.O.; Sundewall, H. Swedish Radiation Protection Inst., Stockholm (Sweden). Mar 1993. 32p. (In Swedish). Order Number DE94600347. Source: OSTI; NTIS; INIS.

The Swedish Government has allocated SEK 11 million for support in radiation protection to Central and Eastern Europe, particularly the Baltic states and Russia. The Swedish Radiation Protection Institute is in charge of this program, commonly referred to as Radiation Protection - East. The support will be given in the form of consultancy services, measurement equipment, computer hardware and software, etc. Some 40 projects have been initiated and prioritized in discussions with relevant parties in the East, and bilateral protocols on cooperation have been signed. Most of the projects are in progress and some have already been finalized. An introduction to the aims, organization and practical experience of the work is given in this report, together with a presentation of all

ongoing and planned projects. A financial statement and a quick glance at suggested future projects conclude the report.

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Refer also to citation(s) 32322, 32327, 32373, 32415, 32424, 32474, 32581, 32609, 32613, 32725, 32730, 32740, 32741, 32774, 32787, 32798, 32806, 32810, 32903, 32911, 32922, 32935, 32936, 32937, 32938, 32939, 32945, 32950, 32951, 32953, 32955, 32976, 32979, 33016, 33017, 33079, 33112, 33206, 33346, 33350, 33351, 33374, 33375, 33377, 33381, 33382, 33395, 33398, 33401, 33405, 33413, 33420, 33425, 33515, 33518, 33569, 33615, 33698, 33726, 33728, 33770, 33771, 33787, 33791, 33792, 33845, 33870, 33969, 33972, 33986, 33990, 34001, 34003, 34010, 34050, 34241, 34423, 34424, 34425, 34459, 34697, 34704, 34706, 34707

34641 (ANL/MCS/CP–80151) **Using semantic information for processing negation and disjunction in logic programs.** Gaasterland, T. (Argonne National Lab., IL (US)); Lobo, J. Argonne National Lab., IL (United States). [1993]. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9306151–1: 7. international symposium on methodologies for intelligent systems, Trondheim (Norway), 15-18 Jun 1993). Order Number DE93017412. Source: OSTI; NTIS; GPO Dep.

There are many applications in which integrity constraints can play an important role. An example is the semantic query optimization method developed by Chakravarthy, Grant, and Minker for definite deductive databases. They use integrity constraints during query processing to prevent the exploration of search space that is bound to fail. In this paper, the authors generalize the semantic query optimization method to apply to negated atoms. The generalized method is referred to as semantic compilation. They show that semantic compilation provides an alternative search space for negative query literals. They also show how semantic compilation can be used to transform a disjunctive database with or without functions and denial constraints without negation into a new disjunctive database that complies with the integrity constraints.

34642 (ANL/MCS/CP–80307) **p4-Linda: A portable implementation of Linda.** Butler, R.M. (University of North Florida, Jacksonville, FL (United States). Div. of Computer and Information Science); Leveton, A.L.; Lusk, E.L. Argonne National Lab., IL (United States). [1993]. 9p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract W-31109-ENG-38. Grant CCR-9121875. (CONF-9307111–: 2. international symposium on high-performance distributed computing, Spokane, WA (United States), 20-23 Jul 1993). Order Number DE93017752. Source: OSTI; NTIS; GPO Dep.

Facilities such as interprocess communication and protection of shared resources have been added to operating systems to support multiprogramming and have since been adapted to exploit explicit multiprocessing within the scope of two models: the shared-memory model and the distributed (message-passing) model. When multiprocessors (or networks of heterogeneous processors) are used for explicit parallelism, the difference between these models is exposed to the programmer. The p4 tool set was originally developed to buffer the programmer from synchronization issues while offering an added advantage in portability, however two models are often still needed to develop parallel algorithms. We provide two implementations of Linda in an attempt to support a single high-level programming model on top of the existing paradigms in order to provide a consistent semantics regardless of the underlying model. Linda's fundamental properties associated with generative communication eliminate the distinction between shared and distributed memory.

34643 (ANL/MCS-TM–177) **Early experiences with the IBM SP-1.** Gropp, W. (ed.). Argonne National Lab., IL (United States). Jun 1993. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93018398. Source: OSTI; NTIS; GPO Dep.

The IBM SP-1 is IBM's newest parallel distributed-memory computer. As part of a joint project with IBM, Argonne took delivery of an early system in order to evaluate the software environment and to begin porting programming packages and applications to this machine. This report discusses the results of those early efforts. Despite the newness of the machine and the lack of a fast interprocessor switch (part of the SP-1 but not yet available for the machine), every code that they attempted to port ran on the SP-1 with little or no modification. The report concludes with a discussion of expectations for the fast interconnect.

34644 (ANL/NDM–128) **A least-squares computational "tool kit": Nuclear data and measurements series.** Smith, D.L. Argonne National Lab., IL (United States). Apr 1993. 77p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. Order Number DE93018400. Source: OSTI; NTIS; INIS; GPO Dep.

The information assembled in this report is intended to offer a useful computational "tool kit" to individuals who are interested in a variety of practical applications for the least-squares method of parameter estimation. The fundamental principles of Bayesian analysis are outlined first and these are applied to development of both the simple and the generalized least-squares conditions. Formal solutions that satisfy these conditions are given subsequently. Their application to both linear and non-linear problems is described in detail. Numerical procedures required to implement these formal solutions are discussed and two utility computer algorithms are offered for this purpose (codes LSIOD and GLSIOD written in FORTRAN). Some simple, easily understood examples are included to illustrate the use of these algorithms. Several related topics are then addressed, including the generation of covariance matrices, the role of iteration in applications of least-squares procedures, the effects of numerical precision and an approach that can be pursued in developing data analysis packages that are directed toward special applications.

34645 (CONF-9302135–2) **The evolution of the PVM concurrent computing system.** Giest, G.A. (Oak Ridge National Lab., TN (United States)); Sunderam, V.S. Oak Ridge National Lab., TN (United States). [1993]. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. From Institute for Electronic and Electrical Engineers (IEEE) COMPON spring meeting; San Francisco, CA (United States); 22-26 Feb 1993. Order Number DE93017764. Source: OSTI; NTIS; GPO Dep.

Concurrent and distributed computing, using portable software systems or environments on general purpose networked computing platforms, has recently gained widespread attention. Many such systems have been developed, and several are in production use. This paper describes the evolution of the PVM system, a software infrastructure for concurrent computing in networked environments. PVM has evolved over the past years; it is currently in use at several hundred institutions worldwide for applications ranging from scientific supercomputing to high performance computations in medicine, discrete mathematics, and databases, and for learning parallel programming. We describe the historical evolution of the PVM system, outline the programming model and supported features, present results gained from its use, list representative applications from a variety of disciplines that PVM has been used for, and comment on future trends and ongoing research projects.

34646 (DOE/ER/13190–8) **Singularities and symmetries of nonlinear ordinary and partial differential equations: Final technical report.** Chu, C.K. Columbia Univ., New York, NY (United States). [1993]. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract FG02-84ER13190. Order Number DE93040083. Source: OSTI; NTIS; GPO Dep.

Real singularities govern self-focusing singularities and current sheet formation. Complex singularities govern integrable properties, nonintegrable properties, intermittency, and from propagation. This project has studied singularities as both fundamental mathematical objects and as the determining mechanism of crucial physical processes. During the past year, progress was made on: Painleve property and geometry of solvable groups, singularity clustering and psi-lambda series, and current sheet formation in MHD.

34647 (DOE/ER/25122–4) **Optimal eigenvalue computation on distributed-memory MIMD multiprocessors.** Crivelli, S.; Jessup, E.R. Colorado Univ., Boulder, CO (United States). Dept. of

Computer Science. Oct 1992. 20p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract FG02-92ER25122 ;AC05-84OR21400. Grant CCR-9109785. (CU-CS–617-92;CONF-930331–14: 6. Society for Industrial and Applied Mathematics (SIAM) conference on parallel processing for scientific computing, Norfolk, VA (United States), 21-24 Mar 1993). Order Number DE93018337. Source: OSTI; NTIS; GPO Dep.

Simon proves that bisection is not the optimal method for computing an eigenvalue on a single vector processor. In this paper, we show that his analysis does not extend in a straightforward way to the computation of an eigenvalue on a distributed-memory MIMD multiprocessor. In particular, we show how the optimal number of sections (and processors) to use for multisection depends on variables such as the matrix size and certain parameters inherent to the machine. We also show that parallel multisection outperforms the variant of parallel bisection proposed by Swarztrauber or this problem on a distributed-memory MIMD multiprocessor. We present the results of experiments on the 64-processor Intel iPSC/2 hypercube and the 512-processor Intel Touchstone Delta mesh multiprocessor.

34648 (DOE/ER/25122–5) **A programming paradigm for distributed-memory computers.** Crivelli, S.; Jessup, E.R. Colorado Univ., Boulder, CO (United States). Dept. of Computer Science. 30 Dec 1992. 4p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States). DOE Contract FG02-92ER25122. Grant CCR-9109785. (CONF-930331–13: 6. Society for Industrial and Applied Mathematics (SIAM) conference on parallel processing for scientific computing, Norfolk, VA (United States), 21-24 Mar 1993). Order Number DE93018336. Source: OSTI; NTIS; GPO Dep.

One of the problems that arises in programming a multicomputer is the effective partitioning of the work into tasks and the assigning of those tasks to the processors. We will present a programming paradigm as a method of structuring the algorithms, allowing us to identify and separate programming phases. This paradigm allows us to develop a general software tool for dynamically allocating work to the processors while hiding many details of load balancing. Our paradigm consists of four phases: partitioning the work, mapping the tasks into the processors connected by some virtual topology, running the application program, and embedding the virtual architecture into the actual machine. The paradigm applies to diverse problems and to a variety of multiprocessors without significant reprograming. We will use the multisection method for computing eigenvalues to show how this tool works.

34649 (DOE/FTR–93015530) **Travel to Switzerland to discuss several issues related to computer graphics technology in an effort to understand which direction CERN is moving in this area: Foreign trip report, March 8–16, 1992.** O'Reilly, C. Fermi National Accelerator Lab., Batavia, IL (United States). 20 Mar 1992. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000. Order Number DE93015530. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of this trip was to discuss several issues related to computer graphics technology in an effort to understand which direction CERN is moving in this area and how the two laboratories can work synergistically to provide HEP physicists with the best graphics tools. In addition, the traveler shared FNAL's experiences with X terminals with our counterparts at CERN and again build synergies between the two laboratories.

34650 (ENEA-RT-ENERG–91-07) **Constrained functions optimization codes: General applicability.** Lorenzoni, G. (ENEA, Casaccia (Italy). Area Energetica). Feb 1993. 22p. (In Italian). (RT/ENERG–91-07). Order Number DE93522951. Source: OSTI; NTIS (US Sales Only).

Two FORTRAN programs for constrained functions optimization of general applicability are described. The treatment of FORTRAN or table functions is possible. The first program, named REGR, interpolates the studied function, using least squares method. The later program, named LAGR, using Lagrange multipliers method, calculates and orders the possible maximum (or minimum) points of the polynomial produced by REGR.

34651 (ESTSC–000182AL00000) **PDS SHRINK: PDS SHRINK.** Phillion, D. (Lawrence Livermore National Lab., CA (United States)). Lawrence Livermore National Lab., CA (United States). 15 Dec 1991. Sponsored by USDOE, Washington, DC (United States). Source: ESTSC.

Description: APPLE MACINTOSH; Machine Dependent; FORTRAN; 3 3.5 Diskettes.

This code enables one to display, take line-outs on, and perform various transformations on an image created by an array of integer*2 data. Uncompressed eight-bit TIFF files created on either the Macintosh or the IBM PC may also be read in and converted to a 16 bit signed integer image. This code is designed to handle all the formats used for PDS (photo-densitometer) files at the Lawrence Livermore National Laboratory. These formats are all explained by the application code. The image may be zoomed infinitely and the gray scale mapping can be easily changed. Line-outs may be horizontal or vertical with arbitrary width, angled with arbitrary end points, or taken along any path. This code is usually used to examine spectrograph data. Spectral lines may be identified and a polynomial fit from position to wavelength may be found. The image array can be remapped so that the pixels all have the same change of lambda width. It is not necessary to do this, however. Lineouts may be printed, saved as Cricket tab-delimited files, or saved as PICT2 files. The plots may be linear, semilog, or logarithmic with nice values and proper scientific notation. Typically, spectral lines are curved.

34652 (ESTSC–000218IBMPC02) **BPM3.0S: Fossil-Fired Boilers.** Kemeny, P. (Burns and Roe Co., Oradell, NJ (United States)); Lagomarsino, J.; Clarke, D.; Kluge, C.R.; Woods, G.; Miller, D.; Landry, A. Burns and Roe Services Corp., Pittsburgh, PA (United States). 1 May 1992. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC22-89PC88400. Source: ESTSC.

Description: IBM PC; DOS 3.1; Microsoft QuickBASIC; 6 3.5 Diskettes. The SOURCE CODE IS AVAILABLE. The program also checks the required minimum average cold end temperature. If the average cold end temperature is less than the allowable minimum, the air inlet temperature is increased until this requirement is met. The printout will show the total increase in the air inlet temperature over the base temperature of 80 degrees Fahrenheit. The estimated heat input to increase the inlet air temperature to the required temperature is also given to show the required duty of a steam coil air preheater. Directories and paths are hard coded in the source code.

Boiler Performance Model (BPM 3.0S) is a set of computer programs developed to analyze the performance of fossil-fired utility boilers. The programs can model a wide variety of boiler designs, and can model coal, oil, or natural gas firing. The programs are intended for use by engineers performing analyses of alternative fuels, alternative operating modes, or boiler modifications.

34653 (ESTSC–000324IB38600) **EQ3/6 V7.2: Geochemical Modeling Of Aqueous Systems.** Wolery, T.J. (Lawrence Livermore National Lab., CA (United States)). Lawrence Livermore National Lab., CA (United States). 1 Sep 1992. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Source: ESTSC; Lawrence Livermore National Lab.

Description: IBM PC 386; DOS 5.0 or higher with MicroSoftLahey extended Fortran (F77L-EM/32, v. 5.01) with DOS system calls; 4 5.25 Diskettes. EQ3NR input files end in .3i, EQ6 input files end in .6i. This is a recommended convention, and it is required in order to run these codes using the PC interface software. The data file names have the form exemplified by data0.com. Here com is one of the five data file descriptors. This general form is required to run the RUNEQPT script. The main code FORTRAN source files end in .fsc. The PC interface software source codes end in .for. The EPCLIB library supports the PC interface codes. This library is included in the distribution package.

EQ3/6 is a software package for geochemical modeling of aqueous systems. This description pertains to version 7.2. It addresses aqueous speciation, thermodynamic equilibrium, disequilibrium, and chemical kinetics. The major components of the package are EQ3NR, a speciation-solubility code, and EQ6 a reaction path code. EQ3NR is useful for analyzing groundwater chemistry data,

calculating solubility limits, and determining whether certain reactions are in states of equilibrium or disequilibrium. It also initializes EQ6 calculations. EQ6 models the consequences of reacting an aqueous solution with a specified set of reactants (e.g., minerals or waste forms). It can also model fluid mixing and the effects of changes in temperature. Each of five supporting data files contain both standard state and activity coefficient-related data. Three support the use of the Davies or B-dot equations for the activity coefficients; the other two support the use of Pitzer's equations. The temperature range of the thermodynamic data on the data files varies from 25 degrees C only to 0-300 degrees C.

34654 (ESTSC–000324IB48600) **EQ3/6 V7.2: Geochemical Modeling Of Aqueous Systems.** Wolery, T.J. (Lawrence Livermore National Lab., CA (United States)). Lawrence Livermore National Lab., CA (United States). 1 Sep 1992. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Source: ESTSC; Lawrence Livermore National Lab.

Description: IBM 486; DOS 5.0 or higher with MicroSoftLashey extended Fortran (F77L-EM/32, v. 5.01), with DOS system calls.; 4 5.25 Diskettes. EQ3NR input files end in .3i, EQ6 input files end in .6i. This is a recommended convention, and it is required in order to run these codes using the PC interface. The data file names have the form exemplified by data0.com. Here com is one of the five data file descriptors. The main code FORTRAN source files end in .fsc. The PC interface software source codes end in .for. The EPCLIB library supports the PC interface codes. This library is included in the distribution package.

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34655 (ESTSC–000581IBMPC01) **APS1.2: Costs of Building Waste Facilities; Price Per Shipment to Recoup Costs.** Smith, P. (EG and G Idaho, Idaho Falls, ID (United States)). EG and G Idaho, Inc., Idaho Falls, ID (United States). 3 Sep 1993. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Source: ESTSC.

Description: IBM PC; MS-DOS 5.0, PKZIP 2.046 used to Modula-2; 1 3.5 Diskette. Calls to M2SAGE, a library of reusable Modula-2 code, represent approximately 33 percent of the code. .EXE indicates executable modules, .DFL indicates the data dictionary, .DAT and .IDX indicate the data and index files, .DOC indicates user manual documentation. PKZIP 2.046 used to compress/uncompress files. APS.DOC is the user manual. It was created using Word Perfect 5.1. It is intended for print out to an Hewlett Packard Laser-Jet III or better with fully scalable fonts.

The Automated Pricing Schedule is a computer model for evaluating the economics of developing, operating, and closing a low-level radioactive waste disposal site. It provides pricing for individual shipments based on the characteristics of the shipment, and calculates a disposal fee to be charged for each shipment to recover the costs of the facility. It includes a sensitivity analysis module to evaluate the effect of varying the parameters of the model.

34656 (ESTSC–000593IBMPC00) **GTIPS: Greater Than Class C Tracking, Inventory and Projections System.** Frasure, J. (EG and G Idaho Inc., Idaho Falls, ID (United States)); Stacey, M. EG and G Idaho, Inc., Idaho Falls, ID (United States). 1 Jan 1993. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-76ID01570. Source: ESTSC.

Description: IBM PC; SCO-Unix; Oracle SQL*Forms 3.0 (95%), C (5%); 1 3.5 Diskette. Reports have the file extension of .TXT, the source for the forms have the extension of .INP, form executables have the file extension .FRM, and the C code has the extension of .PC.

The GTIPS was developed as part of the National Low-Level Waste Management Program's effort to characterize GTCC waste. The primary purpose of this system is to store the Energy Information Administration's (EIA) 1985 survey information (as well as future surveys by the program) in a central location; retrieve data with specific attributes or logical combinations of attributes; generate output in a textual or tabular form to aid in the preparation of reports and other documents required by the user; project a trend of disposal GTCC volumes and activities into the future to aid the user in decision making for the storage and disposal of GTCC waste.

34657 (ESTSC–000601IBMPC00) **IMCS: Item Management Control System.** White, L. (EG and G Idaho Inc., Idaho Falls, ID (United States)); Boyd, K. EG and G Idaho, Inc., Idaho Falls, ID (United States). 1 Apr 1990. Sponsored by USDOE, Washington, DC (United States). Source: ESTSC.

Description: IBM PC; DOS 2.11 or greater; Modula; 1 3.5 Diskette. The system was developed using Modula and a database development library called Sage. The software will run on any IBM-PC or similar, using DOS2.11 or greater, and at least 640 k of internal memory. The software supports various types of users, established at the time of software installation; however, because of the DOS environment, it will only support one user at a time.

The Item Management Control System (IMCS) has been developed at Idaho National Engineering Laboratory to assist in organizing collections of documents using an IBM-PC or similar DOS system platform.

34658 (ESTSC–000608IBMPC00) **RSAC-5.1: Radiological Safety Analysis Computer Program.** Wenzel, D.R. (Westinghouse Idaho Nuclear Company, Inc., Idaho Falls, ID (United States)). Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States). 1 Oct 1993. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC07-84ID12435. Source: ESTSC.

Description: IBM PC; DOS with a math co-processor; RSAC-5.1 FortranIV, RSAC+ Clarion Professional; 1 3.5 Diskette. While RSAC+ is provided to prepare RSAC-5.1 input files, users can run RSAC-5.1 directly from ASCII files. SOURCE CODE NOT INCLUDED.

RSAC-5.1 calculates the consequences of the release of radionuclides to the atmosphere. Running on a personal computer with a math co-processor, it models the source term from a nuclear event, including generation of fission product inventory from either reactor operating history or criticality events. Users can also input individual nuclides. Source term modelling allows for complete progeny ingrowth and decay during all accident phases. RSAC-5.1 release scenario modelling allows fractionation by chemical group or element and calculates decay and ingrowth during transport through processes, facilities and environment. RSAC-5.1 models the effect of HEPA filters or other clean-up systems. It simulates release through linear or exponential models. RSAC-5.1 meteorological capabilities include Gaussian plume diffusion for Pascal-Gifford, Hilsmeier-Gifford, and Markee models. A unique capability is the ability to model Class F fumigation conditions. Optionally, users supply sigmas or x/Qs to the code as input data. RSAC-5.1 also includes corrections for plume rise and building wake. Calculation of dose can be performed for pathways, including inhalation, ingestion, ground surface, air immersion, water immersion and cloud gamma dose from semi-infinite plume models and finite plume models. A fifty mile population dose, including Regulatory Guide 1.109 modeling, is also available. RSAC-5.1 has been subjected to extensive validation and verification consistent with its historical use for safety related calculations in support of safety analysis reports.

34659 (FNAL/C–93/076) **A multi-thread approach to coalescing small transfers generated by portable tool sets.** Fischler, M.; Uchima, M. Fermi National Accelerator Lab., Batavia, IL (United States). Apr 1993. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC02-76CH03000.

(CONF-931115–1: Supercomputing conference on high performance computing and communications, Portland, OR (United States), 15-19 Nov 1993). Order Number DE93012128. Source: OSTI; NTIS; GPO Dep.

An approach to providing scientific users with the means to code complex algorithms in a natural way is to provide portable tool sets implementing the concepts of each scientific field. These tool sets facilitate implementation on massively parallel systems, but often tend toward large numbers of small inter-CPU data transfers, adversely impacting efficiency. We present techniques for mitigating this effect without affecting the way the user sees the tools. Efficiency improvements obtained by transfer coalescing via "multithreading" are studied in the context of Lattice Gauge Theory computations.

34660 (KEK-PROC–92-16) **Proceedings of the second EGS4 user's meeting in Japan.** Hirayama, Hideo; Namito, Yoshihito; Ban, Syuichi (eds.). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Dec 1992. 70p. (In Japanese). (CONF-9207216–: 2. EGS4 user's meeting in Japan, Tsukuba (Japan), 20-22 Jul 1992). Order Number DE93520383. Source: OSTI; NTIS; INIS.

This report is the summary of the lectures in second EGS4 study meeting held under the auspices of the Radiation Safety Management Center at National Laboratory for High Energy Physics, from July 20 to 22, 1992. In the study meeting, 79 persons took part, and the new users of EGS4 seem to expand, taking the opportunity of this study meeting. In 13 lectures on the research using EGS4, the stories in wide fields were able to be heard. The interchange of the researches in various fields was able to be carried out through the common means of EGS4, and it was significant. (K.I.).

34661 (LA-SUB–93-214) **Probability computations using the SIGMA-PI method on a personal computer.** Haskin, F.E. (Univ. of New Mexico, Albuquerque, NM (US). Dept. of Chemical and Nuclear Engineering); Lazo, M.S.; Heger, A.S. Los Alamos National Lab., NM (United States); New Mexico Univ., Albuquerque, NM (United States). Dept. of Chemical and Nuclear Engineering. 30 Sep 1990. 48p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. Order Number DE93019300. Source: OSTI; NTIS; GPO Dep.

The SIGMA-PI ($\Sigma\Pi$) method as implemented in the SIGPI computer code, is designed to accurately and efficiently evaluate the probability of Boolean expressions in disjunctive normal form given the base event probabilities. The method is not limited to problems in which base event probabilities are small, nor to Boolean expressions that exclude the compliments of base events, nor to problems in which base events are independent. The feasibility of implementing the $\Sigma\Pi$ method on a personal computer has been evaluated, and a version of the SIGPI code capable of quantifying simple Boolean expressions with independent base events on the personal computer has been developed. Tasks required for a fully functional personal computer version of SIGPI have been identified together with enhancements that could be implemented to improve the utility and efficiency of the code.

34662 (LA-UR–93-1244) **A parallel hashed oct-tree N-body algorithm.** Warren, M.S. (Los Alamos National Lab., NM (United States)); Salmon, J.K. Los Alamos National Lab., NM (United States). 29 Mar 1993. 22p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-931115–3: Supercomputing conference on high performance computing and communications, Portland, OR (United States), 15-19 Nov 1993). Order Number DE93012654. Source: OSTI; NTIS; GPO Dep.

We report on an efficient adaptive N-body method which we have recently designed and implemented. The algorithm computers the forces on an arbitrary distribution of bodies in a time which scales as N log N with particle number. The accuracy of the force calculations is analytically bounded, and can be adjusted via a user defined parameter between a few percent relative accuracy, down to machine arithmetic accuracy. Instead of using pointers to indicate the topology of the tree, we identify each possible cell with a key. The mapping of keys into memory locations is achieved via a hash table. This allows us to access data in an efficient manner across multiple processors using a virtual shared memory model. Performance of the parallel program is measured on the 512 processor Intel Touchstone Delta system. We also comment on a number of wide-ranging applications which can benefit from application of this type of algorithm.

34663 (LA-UR–93-2585) **Computer/information security design approaches for Complex 21/Reconfiguration facilities.** Hunteman, W.J. (Los Alamos National Lab., NM (United States)); Zack, N.R.; Jaeger, C.D. Los Alamos National Lab., NM (United States). [1993]. 8p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-36. (CONF-930749–39: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93018547. Source: OSTI; NTIS; GPO Dep.

Los Alamos National Laboratory and Sandia National Laboratories have been designated the technical lead laboratories to develop the design of the computer/information security, safeguards, and physical security systems for all of the DOE Complex 21/Reconfiguration facilities. All of the automated information processing systems and networks in these facilities will be required to implement the new DOE orders on computer and information security. The planned approach for a highly integrated information processing capability in each of the facilities will require careful consideration of the requirements in DOE Orders 5639.6 and 1360.2A. The various information protection requirements and user clearances within the facilities will also have a significant effect on the design of the systems and networks. Fulfilling the requirements for proper protection of the information and compliance with DOE orders will be possible because the computer and information security concerns are being incorporated in the early design activities. This paper will discuss the computer and information security addressed in the integrated design effort, uranium/lithium, plutonium, plutonium high explosive/assembly facilities.

34664 (LITH-MAT-R–93-10) **Efficient decomposition and linearization methods for the stochastic transportation problem.** Holmberg, K. Linkoeping Univ. (Sweden). Dept. of Mathematics. [1993]. 28p. Order Number DE94600343. Source: OSTI; NTIS; INIS.

The stochastic transportation problem can be formulated as a convex transportation problem with nonlinear objective function and linear constraints. We compare several different methods based on decomposition techniques and linearization techniques for this problem, trying to find the most efficient method or combination of methods. We discuss and test a separable programming approach, the Frank-Wolfe method with and without modifications, the new technique of mean value cross decomposition and the more well known Lagrangian relaxation with subgradient optimization, as well as combinations of these approaches. Computational tests are presented, indicating that some new combination methods are quite efficient for large scale problems. (authors) (27 refs.).

34665 (NEI-NO–349) **Wave forces on three-dimensional floating bodies with small forward speed.** Nossen, J. Oslo Univ. (Norway). Matematisk Inst. 1989. 46p. Order Number DE93516703. Source: OSTI; NTIS.

A boundary integral method is developed for computing first-order and mean second-order wave forces on floating bodies with small forward speed in three dimensions. The method is based on applying Green's theorem and linearizing the Green function and velocity potential in the forward speed. The velocity potential on the wetted body surface is then given as the solution of two sets of integral equations with unknowns only on the body. The equations contain no waterline integral, and the free surface integral decays rapidly. The Timman-Newman symmetry relations for the added mass and damping are extended to the case when the double-body flow around the body is included in the free surface condition. The linear wave exciting forces are found both by pressure integration and by a generalized far-field form of the Haskind relations. The mean drift force is found by far-field analysis. All the derivations are made for an arbitrary wave heading. A boundary element program utilizing the new method has been developed. Numerical results and convergence tests are presented for several body geometries. It is found that interference phenomena may lead to negative wave drift damping for bodies of complicated shape. 13 refs., 24 figs.

34666 (NEI-NO–357) **Sparse solution of finite element equations.** Damhaug, A.C. Trondheim Univ. (Norway). Norges Tekniske Hoegskole. Sep 1992. 162p. Order Number DE93525289. Source: OSTI; NTIS.

In this work the use of sparse matrix technology in connection with the finite element method has been considered with particular address to large-scale applications. Traditionally the preprocessing phase involved when sparse matrix algorithms are used is expensive compared to envelope methods. A careful study of each necessary step in the preprocessing phase has been made in order to reduce the central processing unit (CPU) time consumption as much as possible. It turned out that there are inherent properties of the finite element method that can be exploited. The result is that the present implementation of the sparse preprocessing phase is comparable to the envelope method both with respect to CPU-time consumption and to storage requirements throughout the phase. This applies to all the test problems used. The current implementation of the preprocessing phase can handle both complete- and partial-factorization. Superelement technique is a well known strategy in computational structural mechanics to solve large problems. The strategy is viewed as a hierarchical method contained in the class of multifront methods, where the superelements are prescribed by the user. The main concern in this study has been to improve the partial factorization step which is needed in the static condensation phase. This is the most demanding step with respect to CPU-time consumption. The present algorithm and its true sparse implementation perform better than both envelope methods and standard sparse methods on the three dimensional shell and solid problems analysed as a part of this study. In addition to the superelement technique the standard multifront technique has also been studied. This technique is ideally suited to the finite element method and its performance on vector supercomputers is good. Out-of-core techniques are logically simple with this method. 87 refs., 48 figs., 12 tabs.

34667 (ORNL/TM–12252) **PUMMA: Parallel Universal Matrix Multiplication Algorithms on distributed memory concurrent computers.** Choi, Jaeyoung (Oak Ridge National Lab., TN (US)); Walker, D.W.; Dongarra, J.J. Oak Ridge National Lab., TN (United States). Aug 1993. 39p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. Contract DAAL03-91-C-0047. Order Number DE93019163. Source: OSTI; NTIS; GPO Dep.

This paper describes the Parallel Universal Matrix Multiplication Algorithms (PUMMA) on distributed memory concurrent computers. The PUMMA package includes not only the non-transposed matrix multiplication routine $C = A \cdot B$, but also transposed multiplication routines $C = A^T \cdot B$, $C = A \cdot B^T$, and $C = A^T \cdot B^T$, for a block scattered data distribution. The routines perform efficiently for a wide range of processor configurations and block sizes. The PUMMA together provide the same functionality as the Level 3 BLAS routine xGEMM. Details of the parallel implementation of the routines are given, and results are presented for runs on the Intel Touchstone Delta computer.

34668 (ORNL/TM–12318) **Software distribution using xnetlib.** Dongarra, J.J. (Univ. of Tennessee, Knoxville, TN (US). Dept. of Computer Science); Rowan, T.H.; Wade, R.C. Oak Ridge National Lab., TN (United States). Jun 1993. 15p. Sponsored by USDOE, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93018278. Source: OSTI; NTIS; GPO Dep.

Xnetlib is a new tool for software distribution. Whereas its predecessor netlib uses e-mail as the user interface to its large collection of public-domain mathematical software, xnetlib uses an X Window interface and socket-based communication. Xnetlib makes it easy to search through a large distributed collection of software and to retrieve requested software in seconds.

34669 (ORNL/TM–12347) **The Fourier analysis technique and epsilon-pseudo-eigenvalues.** Donato, J.M. Oak Ridge National Lab., TN (United States). Jul 1993. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93018805. Source: OSTI; NTIS; GPO Dep.

The spectral radii of iteration matrices and the spectra and condition numbers of preconditioned systems are important in forecasting the convergence rates for iterative methods. Unfortunately, the spectra of iteration matrices or preconditioned systems is rarely easily available. The Fourier analysis technique has been shown to be a useful tool in studying the effectiveness of iterative methods by determining approximate expressions for the eigenvalues or condition numbers of matrix systems. For non-symmetric matrices the eigenvalues may be highly sensitive to perturbations. The spectral radii of nonsymmetric iteration matrices may not give a numerically realistic indication of the convergence of the iterative method. Trefethen and others have presented a theory on the use of ϵ-pseudo-eigenvalues in the study of matrix equations. For Toeplitz matrices, we show that the theory of ϵ-pseudo-eigenvalues includes the Fourier analysis technique as a limiting case. For non-Toeplitz matrices, the relationship is not clear. We shall examine this relationship for non-Toeplitz matrices that arise when studying preconditioned systems for methods applied to a two-dimensional discretized elliptic differential equation.

34670 (ORNL/TM–12388) **Are bilinear quadrilaterals better than linear triangles?.** D'Azevedo, E.F. Oak Ridge National Lab., TN (United States). Aug 1993. 31p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93019223. Source: OSTI; NTIS; GPO Dep.

This paper compares the theoretical effectiveness of bilinear approximation over quadrilaterals with linear approximation over triangles. Anisotropic mesh transformation is used to generate asymptotically optimally efficient meshes for piecewise linear interpolation over triangles and bilinear interpolation over quadrilaterals. The theory and numerical results suggest triangles may have a slight advantage over quadrilaterals for interpolating convex data function but bilinear approximation may offer a higher order approximation for saddle-shaped functions on a well-designed mesh. This work is a basic study on optimal meshes with the intention of gaining insight into the more complex meshing problems in finite element analysis.

34671 (ORNL/TM–12408) **Inventory management plan for a research and development local area network.** Strickler, D. (Oak Ridge National Lab., TN (US)); Chester, R.; Ingle, K.; Payne, P.; Rome, J.; Kertis, K. Oak Ridge National Lab., TN (United States). Aug 1993. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93018381. Source: OSTI; NTIS; GPO Dep.

An inventory management plan is presented for the local area network (LAN) for the Security Aspects of Database Management Systems, a Department of Energy (DOE)-sponsored project examining computer and network security in a data management environment. The inventory management plan establishes procedures to ensure that changes in system hardware and software are identified and controlled. Management tools are described, and the roles of the project manager, inventory control manager, and research team members in the implementation of inventory management are defined.

34672 A sequencing and fan-out mechanism for dataflow computing. Grafe, V.G.; Hoch, J.E. To Dept. of Energy. 1991. USA patent application 7-751,002. 30p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93019326. Source: OSTI; NTIS; GPO Dep.

A sequencing and data fanout mechanism is provided for a dataflow processor is activated by an input token which causes a sequence of operations to occur by initiating a first instruction to act on data contained within the token and then executing a sequential thread of instructions identified by either a repeat count and an offset within the token, or by an offset within each preceding instruction.

34673 (SAND–92-2521) **How to apply the IEEE standards to software testing.** Klamerus, J.; Weeks, J. Sandia National Labs., Albuquerque, NM (United States). Jun 1993. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018514. Source: OSTI; NTIS; GPO Dep.

Testing is an important part of the software application development process. To achieve quality software deliverables and to avoid costly redevelopment of program code or repair of bad data, testing must be performed throughout the software development life cycle. This paper discusses a software engineering process to produce a software test plan based upon the "IEEE (Institute of Electrical and Electronics Engineers) Software Engineering Standards Collection" guidelines and corporate guidelines. Demonstrated examples of the software testing process involving interactive graphical user interface software and standard ASCII forms-based text are provided. Sandia National Laboratories has a Software Quality Assurance Department which provides corporate guidelines, in addition to recommending the use of IEEE processes. Both corporate guidelines and a specific subset of the IEEE guidelines were applied to the software development projects discussed herein. The rationale for applying a specific subset of the IEEE guidelines for each of the software development projects will be given. The development of the test procedures in the INGRES/WINDOWS 4GL environment (graphical user interface) as well as in the INGRES/ABF environment (Applications-By-Forms, ASCII Text) are presented and contrasted. The documentation of the testing process and results are explained.

34674 (SAND–93-0587) **Downsizing a database platform for increased performance and decreased costs.** Miller, M.M.; Tolendino, L.F. Sandia National Labs., Albuquerque, NM (United States). Jun 1993. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018687. Source: OSTI; NTIS; GPO Dep.

Technological advances in the world of microcomputers have brought forth affordable systems and powerful software than can compete with the more traditional world of minicomputers. This paper describes an effort at Sandia National Laboratories to decrease operational and maintenance costs and increase performance by moving a database system from a minicomputer to a microcomputer.

34675 (SAND–93-0917C) **A visualization environment for supercomputing-based applications in computational mechanics.** Pavlakos, C.J.; Schoof, L.A.; Mareda, J.F. Sandia National Labs., Albuquerque, NM (United States). [1993]. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-931115–7: Supercomputing conference on high performance computing and communications, Portland, OR (United States), 15-19 Nov 1993). Order Number DE93015024. Source: OSTI; NTIS; GPO Dep.

In this paper, we characterize a visualization environment that has been designed and prototyped for a large community of scientists and engineers, with an emphasis in superconducting-based computational mechanics. The proposed environment makes use of a visualization server concept to provide effective, interactive visualization to the user's desktop. Benefits of using the visualization server approach are discussed. Some thoughts regarding desirable features for visualization server hardware architectures are also addressed. A brief discussion of the software environment is included. The paper concludes by summarizing certain observations which we have made regarding the implementation of such visualization environments.

34676 (SAND–93-0934C) **Experience in implementing a parallel file system.** Riesen, R. (New Mexico Univ., Albuquerque, NM (United States). Dept. of Computer Science); Maccabe, A.B.; Wheat, S.R. Sandia National Labs., Albuquerque, NM (United States). Mar 1993. 23p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-931115–4: Supercomputing conference on high performance computing and communications, Portland, OR (United States), 15-19 Nov 1993). Order Number DE93012840. Source: OSTI; NTIS; GPO Dep.

With ever increasing processor and memory speeds, new methods to overcome the "I/O bottleneck" need to be found. This is especially true for massively parallel computers that need to store and retrieve large amounts of data fast and reliably, to fully utilize the available processing power. We have designed and implemented a parallel file system, that distributes the work of transferring data to and from mass storage, across several I/O nodes and communication channels. The prototype parallel file system makes use of the existing single threaded file system of the Sandia/University of New Mexico Operating System (SUNMOS). SUNMOS is a joint project between Sandia National Laboratory and the University of New Mexico to create a small and efficient OS for Massively Parallel (MP) Multiple Instruction, Multiple Data (MIMD) machines. We chose file striping to interleave files across sixteen disks. By using source-routing of messages we were able to increase throughput beyond the maximum single channel bandwidth the default routing algorithm of the nCUBE 2 hypercube allows. We describe our implementation, the results of our experiments, and the influence this work has had on the design of the Performance-oriented, User-managed, Messaging Architecture (PUMA) operating system, the successor to SUNMOS.

34677 (SAND–93-0935C) **Message passing in PUMA.** Maccabe, A.B. (New Mexico Univ., Albuquerque, NM (United States). Dept. of Computer Science); Wheat, S.R. Sandia National Labs., Albuquerque, NM (United States); New Mexico Univ., Albuquerque, NM (United States). Dept. of Computer Science. [1993]. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-931115–5: Supercomputing conference on high performance computing and communications, Portland, OR (United States), 15-19 Nov 1993). Order Number DE93012841. Source: OSTI; NTIS; GPO Dep.

This paper provides an overview of the message passing primitives provided by PUMA (Performance-oriented, User-managed Messaging Architecture). Message passing in PUMA is based on the concept of a portal–an opening in the address space of an application process. Once an application process has established a portal, other processes can write values into the memory associated with the portal using a simple send operation. Because messages are written directly into the address space of the receiving process, there is not need to buffer messages in the PUMA kernel. This simplifies the design of the kernel, increasing its reliability and portability. Moreover, because messages are mapped directly into the address space of the application process, the application can manage the messages that it receives without needing direct support from the kernel.

34678 (SAND–93-0936C) **A massively parallel adaptive finite element method with dynamic load balancing.** Devine, K.D. (Rensselaer Polytechnic Inst., Troy, NY (United States). Dept. of Computer Science); Flaherty, J.E.; Wheat, S.R.; Maccabe, A.B. Sandia National Labs., Albuquerque, NM (United States). [1993]. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-931115–2: Supercomputing conference on high performance computing and communications, Portland, OR (United States), 15-19 Nov 1993). Order Number DE93012844. Source: OSTI; NTIS; GPO Dep.

We construct massively parallel, adaptive finite element methods for the solution of hyperbolic conservation laws in one and two dimensions. Spatial discretization is performed by a discontinuous Galerkin finite element method using a basis of piecewise Legendre polynomials. Temporal discretization utilizes a Runge-Kutta method. Dissipative fluxes and projection limiting prevent oscillations near solution discontinuities. The resulting method is of high order and may be parallelized efficiently on MIMD computers. We demonstrate parallel efficiency through computations on a 1024-processor nCUBE/2 hypercube. We also present results using adaptive p-refinement to reduce the computational cost of the method. We describe tiling, a dynamic, element-based data migration system. Tiling dynamically maintains global load balance in the adaptive method by overlapping neighborhoods of processors, where each neighborhood performs local load balancing. We demonstrate the effectiveness of the dynamic load balancing with adaptive p-refinement examples.

34679 (SAND–93-0940) **Object-oriented DFD models to present the functional and behavioral views.** Maxted, A. Sandia National Labs., Albuquerque, NM (United States). Jun 1993. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93040206. Source: OSTI; NTIS; GPO Dep.

An object-oriented methodology is presented that is based on two sets of Data Flow Diagrams (DFDs): one for the functional

view, and one for the behavioral view. The functional view presents the information flow between shared objects. These objects map to the classes identified in the structural view (e.g., Information Model). The behavioral view presents the flow of information between control components and relates these components to their state models. Components appearing in multiple views provide a bridge between the views. The top-down hierarchical nature of the DFDs provide a needed overview or road map through the software system.

34680 (SAND–93-0941) **A proposal for reverse engineering CASE tools to support new software development.** Maxted, A. Sandia National Labs., Albuquerque, NM (United States). Jun 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93040207. Source: OSTI; NTIS; GPO Dep.

Current CASE technology provides sophisticated diagramming tools to generate a software design. The design, stored internal to the CASE tool, is bridged to the code via code generators. There are several limitations to this technique: (1) the portability of the design is limited to the portability of the CASE tools, and (2) the code generators offer a clumsy link between design and code. The CASE tool though valuable during design, becomes a hindrance during implementation. Frustration frequently causes the CASE tool to be abandoned during implementation, permanently severing the link between design and code. Current CASE stores the design in a CASE internal structure, from which code is generated. The technique presented herein suggests that CASE tools store the system knowledge directly in code. The CASE support then switches from an emphasis on code generators to employing state-of-the-art reverse engineering techniques for document generation. Graphical and textual descriptions of each software component (e.g., Ada Package) may be generated via reverse engineering techniques from the code. These reverse engineered descriptions can be merged with system over-view diagrams to form a top-level design document. The resulting document can readily reflect changes to the software components by automatically generating new component descriptions for the changed components. The proposed auto documentation technique facilitates the document upgrade task at later stages of development, (e.g., design, implementation and delivery) by using the component code as the source of the component descriptions. The CASE technique presented herein is a unique application of reverse engineering techniques to new software systems. This technique contrasts with more traditional CASE auto code generation techniques.

34681 (SAND–93-1355C) **Information surety for today and tomorrow.** Fletcher, S.K. Sandia National Labs., Albuquerque, NM (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930749–33: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93017647. Source: OSTI; NTIS; GPO Dep.

Information Surety is the enhancement of the confidentiality, integrity, and availability of information and software systems. It is attained through sequential steps: identification of software reliability requirements and information protection needs, designing for a balanced level of risk throughout the system, and application of appropriate software and hardware technologies and procedures. The ability to apply these steps when developing systems is impaired by a general lack of understanding of surety issues by system developers, and by the fact that there are many separate areas of knowledge involved that are not currently integrated into a disciplined approach (e.g., risk assessment, information access control in computers and networks, secure messaging, trusted software development). Our best systems today are achieved by clever designers who use ad-hoc methods. In the absence of good development tools, technologies may be applied haphazardly and/or retrofitted, without yielding balanced protection. This paper will take the audience through an exploration of the elements of information surety, some common misconceptions about information surety today, and the even greater challenges on the horizon. It will end with some suggestions for research areas which will help evolve the discipline of information surety.

34682 (SAND–93-1373) **GENSHELL: A genesis database 2D to 3D shell transformation program.** Sjaardema, G.D. Sandia National Labs., Albuquerque, NM (United States). Jul 1993. 37p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. Order Number DE93018694. Source: OSTI; NTIS; GPO Dep.

GENSHELL is a three-dimensional shell mesh generation program. The three-dimensional shell mesh is generated by mapping a two-dimensional quadrilateral mesh into three dimensions according to one of several types of transformations: translation, mapping onto a spherical, ellipsoidal, or cylindrical surface, and mapping onto a user-defined spline surface. The generated three-dimensional mesh can then be reoriented by offsetting, reflecting about an axis, revolving about an axis, and scaling the coordinates. GENSHELL can be used to mesh complex three-dimensional geometries composed of several sections when the sections can be defined in terms of transformations of two-dimensional geometries. The code GJOIN is then used to join the separate sections into a single body. GENSHELL updates the EXODUS quality assurance and information records to help track the codes and files used to generate the mesh. GENSHELL reads and writes two-dimensional and three-dimensional mesh databases in the GENESIS database format; therefore, it is compatible with the preprocessing, postprocessing, and analysis codes in the Sandia National Laboratories Engineering Analysis Code Access System (SEACAS).

34683 (SAND–93-1393C) **Applications of an algebraic Monge property.** Bein, W.W. (American Airlines Decision Technologies, Dallas/Fort Worth Airport, TX (United States)); Brucker, P.; Park, J.K. Sandia National Labs., Albuquerque, NM (United States). [1993]. 5p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-9306216–1: 3. Twente workshop on graphs and combinatorial optimization, Enschede (Netherlands), 2-4 Jun 1993). Order Number DE93016869. Source: OSTI; NTIS; GPO Dep.

When restricted to cost arrays possessing the sum Monge property, many combinatorial optimization problems with sum objective functions become significantly easier to solve. Examples include the usual sum-objective-function versions of the assignment problem, the transportation problem, the traveling-salesman problem, and several shortest-path problems. Furthermore, the more general algebraic assignment and transportation problems, which are formulated in terms of an ordered commutative semigroup $(H, *, \leq)$, are similarly easier to solve given cost arrays possessing the corresponding algebraic Monge property, which requires that for all $i < k$ and $j < \ell$, $a[i,j] * a[k,\ell] \leq a[i,\ell] * a[k,j]$. In this paper, we show that Monge-array results for two sum-of-edge-costs shortest-path problems can likewise be extended to a general algebraic setting, provided the problems' ordered commutative semigroup $(H, *, \leq)$ satisfies one additional restriction. We also show how our algorithms can be modified to solve certain bottleneck shortest-path problems, even though the ordered commutative semigroup $(\Re, \max, \leq)$ naturally associated with bottleneck problems does not satisfy our additional restriction. We also provide improved algorithms for several other bottleneck combinatorial optimization problems whose cost arrays possess the strict bottleneck Monge property. Finally, we show how our bottleneck shortest-path techniques can be used to obtain fast algorithms for a variant of Hirschberg and Larmore's optimal paragraph formation problem, a processor-allocation problem first formulated by Bokhari, and a special case of the bottleneck traveling-salesman problem.

34684 (SOL–93-4) **On the numerical stability of quasi-definite systems.** Gill, P.E. (Univ. of California, San Diego, La Jolla, CA (US). Dept. of Mathematics); Shinnerl, J.R.; Saunders, M.A. Stanford Univ., CA (United States). Systems Optimization Lab. Jun 1993. 9p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract FG03-92ER25117. Grant DDM-9204208;Grant DDM-9204547;Grant N00014-90-J-1242. Order Number DE93019404. Source: OSTI; NTIS; GPO Dep.

The authors discuss the solution of sparse linear equations $Kd = r$, where K is a symmetric and specially structured indefinite matrix

that often arises in numerical optimization. For such K, the indefinite factorization $K = LDL^T$ is known to exist in exact arithmetic with 1 x 1 pivots and no row or column interchanges. It is shown that the stability of the LDL^T factorization of this matrix is naturally connected with the stability of the LDM^T factorization of a closely related unsymmetric positive-definite matrix. Conditions are given that allow the stable numerical solution of this system by Gaussian elimination without row and column interchanges.

34685 (SOL–93-5) **The simplex algorithm with a new primal and dual pivot rule.** Chen, Hsin-Der (Florida Univ., Gainesville, FL (United States). Dept. of Industrial and Systems Engineering); Pardalos, P.M.; Saunders, M.A. Stanford Univ., CA (United States). Systems Optimization Lab. Jun 1993. 9p. Sponsored by USDOE, Washington, DC (United States); National Science Foundation, Washington, DC (United States); Department of Defense, Washington, DC (United States). DOE Contract FG03-92ER25117. Grant DDM-8814075;Contract STC-91-19999;Grant DDM-9204208;Grant Order Number DE93019401. Source: OSTI; NTIS; GPO Dep.

We present a simplex-type algorithm for linear programming that works with primal-feasible and dual-feasible points associated with bases that differ by only one column.

34686 (SSCL–628) **Data-machine Independence (DMI).** Botlo, M.; Jagielski, M.; Miller, L.; Romero, A. Superconducting Super Collider Lab., Dallas, TX (United States). May 1993. 11p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC35-89ER40486. Order Number DE93018008. Source: OSTI; NTIS; GPO Dep.

A distributed data acquisition system (DAQ) should not restrict the number or type of processors used in a given application. For any software applications that must operate on a multi-vendor distributed system, three serious problems have to be addressed regarding data handling: data representation, memory organization, and address alignment. Data representation, memory organization, and address alignment problems are inherent in the various hardware platforms available on the market today. Furthermore, issues such as how to coordinate parallel software efforts on multiple platforms that share data must be resolved. Traditionally such efforts are coordinated through meetings, memos, and documents describing shared data blocks (Data Interface Documents). The traditional approach is risky at best: the frequency of changes demanded by end-users is faster than the rate at which interface documents can be updated. Simple changes in data structures tend to dramatically increase the software development time, as all the tools must be modified to accommodate the changes. In Section 2.0 the authors examine in detail the technical implications for data handling when using distributed applications. In Section 3.0 they compare different approaches in handling the data in distributed environments. The four methods studied are: (1) Abstract Syntax Notation 1 (ASN.1), (2) External Data Representation (XDR), (3) Self Describing Data Format (SDS), and (4) ZEBRA. They compared the four tools with the standard programming method (using "C"). In Section 4.0 they present conclusions of the test using the four different tools.

34687 (UCRL-ID–114259) **A program for passively tracking a target using an array of sensors.** Buhl, M.R. Lawrence Livermore National Lab., CA (United States). Jan 1993. 73p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93019554. Source: OSTI; NTIS; GPO Dep.

The problem of passively tracking a moving signal source has importance in a variety of applications such as radar, sonar, seismology, and radio astronomy. In many applications, only limited information is available about the signal source. It will be assumed here that only the signals which are detected by the sensors and the velocity of the source signal are known. The objective of this document is to present a program which passively tracks a target using an array of sensors. This program is available in MATLAB, version 3.5. The algorithm which is implemented consists of three main parts: time delay estimation, passive localization, and data post processing. Each of these parts are discussed, and the mathematical foundation for their solution given. Following, this the organization of the program is presented, and an example of its usage is given.

34688 (UCRL-JC–112573) **High Performance Fortran: An overview.** Zosel, M.E. Lawrence Livermore National Lab., CA (United States). 23 Dec 1992. 7p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9302135–1: Institute for Electronic and Electrical Engineers (IEEE) COMPON spring meeting, San Francisco, CA (United States), 22-26 Feb 1993). Order Number DE93017181. Source: OSTI; NTIS; GPO Dep.

The purpose of this paper is to give an overview of the work of the High Performance Fortran Forum (HPFF). This group of industry, academic, and user representatives has been meeting to define a set of extensions for Fortran dedicated to the special problems posed by a very high performance computers, especially the new generation of parallel computers. The paper describes the HPFF effort and its goals and gives a brief description of the functionality of High Performance Fortran (HPF).

34689 (UCRL-JC–112716) **The "Pen" penetration analysis code: Comparison with experiments and with CALE calculations.** Simonson, S.C. III. Lawrence Livermore National Lab., CA (United States). Apr 1993. 18p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-931121–11: Annual winter meeting of the American Society of Mechanical Engineers, New Orleans, LA (United States), 28 Nov - 3 dec 1993). Order Number DE93017194. Source: OSTI; NTIS; GPO Dep.

The "Pen" computer program has been developed for the analysis of penetration by shaped charge jets. In addition to standard methods for calculating the depth of penetration and the radius of the hole produced by a stretching jet, Pen contains new methods for treating the onset of particulation and for calculating the depth of penetration by a particulated jet. A Pen analysis was compared with a detailed calculation carried out with the LLNL Arbitrary Lagrangian-Eulerian code CALE. Pen was also applied to the analysis of two shaped charge jet penetration experiments. Pen reproduced the CALE hole profile and the experimental profiles when the effective strength in the steel targets was set to 1.2–1.3 times the yield strength. An experimental value of 1.44 ± 0.19 GPa was obtained for the effective strength of hardened A4340 steel under jet impact.

34690 (UCRL-JC–113561) **Automated call tracking systems.** Hardesty, C. Lawrence Livermore National Lab., CA (United States). Mar 1993. 29p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9303131–2-Vugraphs: Cray Users Group conference, Montreaux (Switzerland), 29 Mar - 2 apr 1993). Order Number DE93017994. Source: OSTI; NTIS; GPO Dep.

Includes vugraphs.

User Services groups are on the front line with user support. We are the first to hear about problems. The speed, accuracy, and intelligence with which we respond determines the user's perception of our effectiveness and our commitment to quality and service. To keep pace with the complex changes at our sites, we must have tools to help build a knowledge base of solutions, a history base of our users, and a record of every problem encountered. Recently, I completed a survey of twenty sites similar to the National Energy Research Supercomputer Center (NERSC). This informal survey reveals that 27% of the sites use a paper system to log calls, 60% employ homegrown automated call tracking systems, and 13% use a vendor-supplied system. Fifty-four percent of those using homegrown systems are exploring the merits of switching to a vendor-supplied system. The purpose of this paper is to provide guidelines for evaluating a call tracking system. In addition, insights are provided to assist User Services groups in selecting a system that fits their needs.

34691 (UCRL-JC–113626) **Texture splats for 3D vector and scalar field visualization.** Crawfis, R.A.; Max, N. Lawrence Livermore National Lab., CA (United States). 6 Apr 1993. 9p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-931080–3: Visualization '93, San Jose, CA (United States), 25-29 Oct 1993). Order Number DE93017104. Source: OSTI; NTIS; GPO Dep.

Volume Visualization is becoming an important tool for understanding large 3D datasets. A popular technique for volume

rendering is known as splatting. With new hardware architectures offering substantial improvements in the performance of rendering texture mapped objects, we present textured splats. An ideal reconstruction function for 3D signals is developed which can be used as a texture map for a splat. Extensions to the basic splatting technique are then developed to additionally represent vector fields.

34692 (UCRL-JC–113823) **Two-dimensional particle-in-cell simulation on transputer arrays.** Dyachenko, A.I. (Landau Inst. of Theoretical Physics, Moscow (RU)); Pushkarev, A.N.; Laypunov, M.A.; Talnykin, E.A.; Omelchenko, Yu.A.; Rubenchik, A.M. Lawrence Livermore National Lab., CA (United States). 3 May 1993. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-931115–8: Supercomputing conference on high performance computing and communications, Portland, OR (United States), 15-19 Nov 1993). Order Number DE93017977. Source: OSTI; NTIS; GPO Dep.

The authors have implemented a particle-in-cell method on a 32 transputer computing network. The tests have shown that the performance of this system reaches 1/8 of the equivalent one for the code optimized for a CRAY Y-MP/2E. The system performance analysis shows that this network remains cost-effective until expanded approximately up to 100 transputers. This transputer equipment has provided an efficient computational tool for investigating a novel physical phenomenon – a collisionless mechanism for separation of different elements in colliding plasma beams.

34693 (UCRL-JC–113858) **Performance and scalability aspects of directory-based cache coherence in shared-memory multiprocessors.** Picano, S. (Purdue Univ., Lafayette, IN (United States). School of Electrical Engineering); Meyer, D.G.; Brooks, E.D. III; Hoag, J.E. Lawrence Livermore National Lab., CA (United States). May 1993. 6p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9308129–1: 22. annual international conference on parallel processing, University Park, PA (United States), 16-20 Aug 1993). Order Number DE93016442. Source: OSTI; NTIS; GPO Dep.

We present a study that accentuates the performance and scalability aspects of directory-based cache coherence in multiprocessor systems. Using a multiprocessor with a software-based coherence scheme, efficient implementations rely heavily on the programmer's ability to explicitly manage the memory system, which is typically handled by hardware support on other bus-based, shared memory multiprocessors. We describe a scalable, shared memory, cache coherent multiprocessor and present simulation results obtained on three parallel programs. This multiprocessor configuration exhibits high performance at no additional parallel programming cost.

34694 (UCRL-JC–113874) **Automated assistance for detecting malicious code.** Crawford, R. (Univ. of California, Davis, CA (US). Dept. of Computer Science); Kerchen, P.; Levitt, K.; Olsson, R.; Archer, M.; Casillas, M. Lawrence Livermore National Lab., CA (United States). 18 Jun 1993. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93018106. Source: OSTI; NTIS; GPO Dep.

This paper gives an update on the continuing work on the Malicious Code Testbed (MCT). The MCT is a semi-automated tool, operating in a simulated, cleanroom environment, that is capable of detecting many types of malicious code, such as viruses, Trojan horses, and time/logic bombs. The MCT allows security analysts to check a program before installation, thereby avoiding any damage a malicious program might inflict.

34695 (UCRL-JC–113875) **The new SPI: More refined and integrated system checks.** Taylor, S.M.H. Lawrence Livermore National Lab., CA (United States). May 1993. 19p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-9310103–1: 4. USENIX UNIX security symposium, Santa Clara, CA (United States), 4-7 Oct 1993). Order Number DE93016429. Source: OSTI; NTIS; GPO Dep.

Current research and development at Lawrence Livermore National Laboratory will soon provide the system/security administrator a new set of tools ranging from monitors and intrusion detection to sensitive information detectors. However, the full potential of both existing and future tools will not be realized until a complimentary set of utilities has been integrated into a single computer security workbench in which the results from one process can be used as input to another. The Security Profile Inspector (SPI), a UNIX and VMS security profiler, has taken the first step toward providing this integration. This is accomplished by using an interpreted query language which allows specific, general, and even recursive queries of system configuration information. The new SPI is extremely flexible, so that users can easily tailor existing checks for their system or even add new checks. Similarly, other tools can ask specific questions, for example limiting their inquiries to a single user or a list of users which meet certain criteria. Furthermore, the query language was designed to support multiple architectures and operating systems and to ease the transition of tools to new platforms.

34696 (UCRL-MA–113603) **CAVEMAN: Configuration And VErsion MANagement: User's guide, v2.1.2.** Dyer, K.M. Lawrence Livermore National Lab., CA (United States). 12 Mar 1993. 164p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. Order Number DE93018066. Source: OSTI; NTIS; GPO Dep.

The mission of the CAVEMAN project is to provide the tools for large code systems so that those who work on them can perform source control and configuration control on UNIX-based file servers, rather than the LC Crays. An outside product called cvs has been chosen as the underlying source control system. The initials stand for "Concurrent Versions System". It is a freeware program that runs on most UNIX stations. To quote from the cvs man page: "cvs is a front end to the rcs revision control system which extends the notion of revision control from a collection of files in a single directory to a hierarchical collection of directories consisting of revision controlled files. These directories and files can be combined together to form a software release. cvs provides the functions necessary to manage these software releases and to control the concurrent editing of source files among multiple software developers." While cvs may be run directly, there are several tasks in the LLNL environment that it seemed either safer or easier to automate. CAVEMAN provides the needed functionality, generally in the form of wrappers to cvs.

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34697 (ANL/MCS/CP–80152) **Restricting query relaxation through user constraints.** Gaasterland, T. Argonne National Lab., IL (United States). [1993]. 14p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-31109-ENG-38. (CONF-9305242–1: International conference on intelligent and cooperative information systems, Rotterdam (Netherlands), 11-14 May 1993). Order Number DE93017413. Source: OSTI; NTIS; GPO Dep.

This paper describes techniques to restrict and to heuristically control relaxation of deductive database queries. The process of query relaxation provides a user with a means to automatically identify new queries that are related to the user's original query. However, for large databases, many relaxations may be possible. The methods to control and restrict the relaxation process introduced in this paper focus the relaxation process and make it more efficient. User restrictions over the data base domain may be expressed as user constraints. This paper describes how user constraints can restrict relaxed queries. Also, a set of heuristics based on cooperative answering techniques are presented for controlling the relaxation process. Finally, the interaction of the methods for relaxing queries, processing user constraints, and applying the heuristic rules is described.

34698 (CONF-931148–1) **An ORACLE CASE history: Experiences with ORACLE CASE tools.** Faby, E.Z. (Tennessee Univ., Knoxville, TN (United States)); Hancock, B.R.; Truett, L.F. Oak Ridge National Lab., TN (United States). 16 Feb 1993. 15p. Sponsored by Department of Defense, Washington, DC (United States). DOE Contract AC05-84OR21400. Agreement 1405-1351-A1. From 17. annual international computer software and applications conference (COMPSAC93); Phoenix, AZ (United States); 3-5 Nov 1993.

Order Number DE93010827. Source: OSTI; NTIS (US Sales Only); GPO Dep.

ORACLE CASE tools were used with limited success during development of a database system for the Army. During project development, the set of tools was used for analysis, design, database implementation, and documentation. The CASE tools provided an acceptable user interface for data entry and data correction; they provided standardized reports and views from which data for customized reports could be extracted. However, they had a number of limitations that significantly increased the effort required to maintain and use the CASE data in each phase of development. In particular, the CASE tools were especially limited in essential functions for modifying the system analysis and design. In addition, a decision was made during system development to change to a different version of the ORACLE Relational Database Management System (RDBMS), thus further reducing the value of the CASE tools.

34699 (DOE–93017197) **Trends in Information Management at Department of Energy Headquarters.** USDOE Assistant Secretary for Human Resources and Administration, Washington, DC (United States). Office of Information Technology Services and Operations. Jun 1993. 55p. Sponsored by USDOE, Washington, DC (United States). Order Number DE93017197. Source: OSTI; NTIS; GPO Dep.

The Trends in Information Resource Management at DOE Headquarters (Trends) is published annually to inform the DOE Headquarters community about changes in the information management environment. The document, in its second year of publication, is becoming more robust as more historical data is available and as the information management environment at Headquarters evolves. One of the purposes of the Trends document is to acquire evidence that Headquarters organizations are assimilating guidance offered in the Emerging Technologies Planning Guide into their IRM strategies. Another purpose is to identify areas of interest and requirements of the Headquarters organizations to direct technology research for future issues of the Guide. These categories have been tentatively established as indicators of the degree of implementation of information management. The main source of data is the Headquarters Organization Plans, which were updated during the long-range update cycle conducted from August to January. Since these plans were published, the Secretary has announced a reorganization of DOE. For the purpose of this document, the information in the various plans is considered to be valid to accomplish the Departmental missions.

34700 (DOE/FTR–93018986) **Travel to Japan to attend the meeting of ISO JTC1 SC21 and its working groups: Foreign trip report, June 12–30, 1993.** Smith, M.L. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. 6 Aug 1993. 86p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00613. Order Number DE93018986. Source: OSTI; NTIS (US Sales Only); GPO Dep.

I attended three related meetings in Yokohama as a US delegate. They were the June 29–30 meeting the SC21 Plenary, the June 15–25 meeting of SC21/WG8, and the June 16–24 meeting of the SC21 Special Working Group on Modelling Facilities. I summarize and report the details of each group separately.

34701 (ENEA-RT-INN–92-34) **ALGO 2.** Vaccari, M. (ENEA, Bologna (Italy). Centro Ricerche Energia 'E. Clementel' - Area Energia e Innovazione); Visparelli, D.; Sola, P.G. Dec 1992. 83p. (In Italian). (RT/INN–92-34). Order Number DE93522945. Source: OSTI; NTIS (US Sales Only).

This report describes a prototype of an on-line documentation and access system to the mathematical, statistical and graphical software managed in the framework of the ENEA (Italian Agency for Energy, New Technologies and the Environment) Algorithms Library. The System, based on a tree structure realized using a set of full-screen menus, is available on the IBM 3090/VF of Bologna Center connected to the ENEA network. The software product IBM-ISPF (Interactive System Facility) was used for building the screen menus.

34702 (ORNL/CDIAC–62) **CDIAC catalog of numeric data packages and computer model packages.** Boden, T.A. (Oak Ridge National Lab., TN (United States). Carbon Dioxide Information Analysis Center); O'Hara, F.M. Jr.; Stoss, F.W. Oak Ridge National Lab., TN (United States). Carbon Dioxide Information Analysis Center. May 1993. 84p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93017675. Source: OSTI; NTIS; INIS; GPO Dep.

The Carbon Dioxide Information Analysis Center acquires, quality-assures, and distributes to the scientific community numeric data packages (NDPs) and computer model packages (CMPs) dealing with topics related to atmospheric trace-gas concentrations and global climate change. These packages include data on historic and present atmospheric CO_2 and CH_4 concentrations, historic and present oceanic CO_2 concentrations, historic weather and climate around the world, sea-level rise, storm occurrences, volcanic dust in the atmosphere, sources of atmospheric CO_2, plants' response to elevated CO_2 levels, sunspot occurrences, and many other indicators of, contributors to, or components of climate change. This catalog describes the packages presently offered by CDIAC, reviews the processes used by CDIAC to assure the quality of the data contained in these packages, notes the media on which each package is available, describes the documentation that accompanies each package, and provides ordering information. Numeric data are available in the printed NDPs and CMPs, in CD-ROM format, and from an anonymous FTP area via Internet. All CDIAC information products are available at no cost.

34703 (ORNL/FTR–4620) **Travel to England for meetings on international standards for information technology: Foreign trip report, April 28–May 18, 1993.** Mason, J.D. Oak Ridge National Lab., TN (United States). 1 Jun 1993. 41p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC05-84OR21400. Order Number DE93014862. Source: OSTI; NTIS (US Sales Only); GPO Dep.

As DOE seeks to move towards electronic production, management, and dissemination of scientific and technical information and the adoption of government and international standards to support that effort, it has for several years been involved in the development of international standards for text preparation and interchange. In support of this effort, the traveler serves as Convenor of ISO/IEC JTC1/SC18/WG8; during this trip he convened the Spring 1993 meeting of WG8 in Exeter, England, and then represented WG8 at the annual Plenary of SC 18, the committee including WG8, in London, England.

34704 (PNL-SA–22358) **Lessons learned in procuring a laser optical disk system.** Berndt, V.L. Pacific Northwest Lab., Richland, WA (United States). May 1993. 21p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC06-76RL01830. Order Number DE93018785. Source: OSTI; NTIS; GPO Dep.

This paper describes an effort to procure an optical disk storage system for the Hanford Radiological Records Program. The project manager evaluated technologies available and compatible to the existing computers. A feasibility study was initiated that incorporates special needs and system costs. A requirements analysis, system design, vendor selection and system implementation and testing are documented. Recommendations applicable to procurement in general are given.

34705 (SAND–93-1701C) **Networked MS Windows 3.1 based Classified Document Control System (CDOCS).** Desonier, L.M. Sandia National Labs., Albuquerque, NM (United States). 1993. 3p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930749–16: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93017880. Source: OSTI; NTIS; GPO Dep.

Current classified document management systems require a tremendous amount of space and extensive manpower to account for, inventory, and protect the documents. Comprehensive analysis of current control and accountability procedures reveal the main problem is the actual handling of the paper itself. The purpose of the Networked Microsoft Windows 3.1 based Classified Document Control System (CDOCS) is to eliminate the paper by scanning and storing images of pages on a personal computer using "write once read mostly" (WORM) high density optical media. By saving

images on the computer, not only can manpower and space requirements be reduced, but the chance of compromise is diminished. As an added benefit, the information is now more readily available to the authorized user and is provided to the user at the user's PC. The network target for CDOCS is Microsoft Windows for Workgroups. Thus, the system is also readily applicable to unclassified document imaging uses.

34706 (SAND–93-1721C) **Understanding requirements via natural language information modeling.** Sharp, J.K.; Becker, S.D. Sandia National Labs., Albuquerque, NM (United States). 1993. 12p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC04-76DP00789. (CONF-930749–12: 34. annual meeting of the Institute of Nuclear Materials Management, Scottsdale, AZ (United States), 18-21 Jul 1993). Order Number DE93017875. Source: OSTI; NTIS; GPO Dep.

Information system requirements that are expressed as simple English sentences provide a clear understanding of what is needed between system specifiers, administrators, users, and developers of information systems. The approach used to develop the requirements is the Natural-language Information Analysis Methodology (NIAM). NIAM allows the processes, events, and business rules to be modeled using natural language. The natural language presentation enables the people who deal with the business issues that are to be supported by the information system to describe exactly the system requirements that designers and developers will implement. Computer prattle is completely eliminated from the requirements discussion. An example is presented that is based upon a section of a DOE Order involving nuclear materials management. Where possible, the section is analyzed to specify the process(es) to be done, the event(s) that start the process, and the business rules that are to be followed during the process. Examples, including constraints, are developed. The presentation steps through the modeling process and shows where the section of the DOE Order needs clarification, extensions or interpretations that could provide a more complete and accurate specification.

34707 (UCRL-JC–112556) **Applying IEEE storage system management standards at the National Storage Laboratory.** Louis, S.; Hyer, S.W. Lawrence Livermore National Lab., CA (United States). 4 Dec 1992. 10p. Sponsored by USDOE, Washington, DC (United States). DOE Contract W-7405-ENG-48. (CONF-930461–5: 12. IEEE symposium on mass storage systems, Monterey, CA (United States), 25 Apr 1993). Order Number DE93018082. Source: OSTI; NTIS; GPO Dep.

Since its inception in 1990, the IEEE Storage System Standards Working Group has identified storage-system management as an area in need of further development The pressing need for standards in storage-system management arises from the requirement to exchange management information and to provide control in a consistent predictable manner between the components of a storage system. An appropriate set of management standards will allow multiple vendors to supply storage management subsystems or applications that are integral to or compatible with new storage systems conforming to future IEEE standards. An early, practical application of IEEE storage-system-management work is being pursued at the National Storage Laboratory (NSL), a recently-formed industrial collaboration at Lawrence Livermore National Laboratory. The NSL's purpose is to develop advanced hardware and software technologies for high-performance, distributed storage systems. Since storage system management is of critical concern, it is being explored in depth at the NSL. Work was initiated to define basic management requirements and develop generalized graphical-user-interface tools using remote-procedure-call mechanisms to implement the NSL's conceptual management framework. Several constraints were imposed on the development of early versions of this work to maintain compatibility with the NSL's underlying UniTree-based software architecture and to provide timely prototypes and proof of concept. The project leverages the on-going standards work of the IEEE Storage System Standards Working Group (SSSWG) and also explores some of the relationships and interactions between IEEE storage-system management and more well known management methods for distributed systems and networks. It will have long term benefits by providing "real-life" storage-system-management requirements to the IEEE SSSWG for validation of evolving standards.

34708 (WSRC-TR–92-433) **Data Qualification guidelines: Task number 90-053-0.** Edwards, T.B.; Shine, E.P. Westinghouse Savannah River Co., Aiken, SC (United States). 2 Sep 1992. 26p. Sponsored by USDOE, Washington, DC (United States). DOE Contract AC09-89SR18035. Order Number DE93019281. Source: OSTI; NTIS; INIS; GPO Dep.

Data Qualification (DQ) is a formal, technical process whose objective is to affirm that experimental data are suitable for their intended use. Although it is not possible to develop a fixed recipe for the DQ process to cover all test situations, these general guidelines have been developed for the Nuclear Engineering Section to establish a framework for qualifying data from steady-state processing. These guidelines outline the role of the DQ team providing insight into the planning and conducting of the DQ process.

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AC06-91RL11978	**Parsons Brinckerhoff Facilities Services, Inc., Herndon, VA (United States)**	
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AC06-92RL12434	**USDOE Richland Field Office, WA (United States)**	
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AC07-76ID01570	**Geological Survey, Idaho Falls, ID (United States)**	
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AC07-88SF17712	**California Univ., San Diego, La Jolla, CA (United States)**	
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AC07-93ID13215	**Coleman Energy and Environmental Systems, Golden, CO (United States). Blackhawk Geosciences Div.**	
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AC08-88NV10617	**Lawrence Livermore National Lab., CA (United States)**	
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	EG and G Energy Measurements, Inc., Goleta, CA (United States). Santa Barbara Operations	
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	18:33855	EGG–10617-2159
AC08-89NV10630	**Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (United States)**	
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AC08-93NV11265	**EG and G Energy Measurements, Inc., Las Vegas, NV (United States). Remote Sensing Lab.**	
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AC21-86MC21023	**Foster Wheeler Development Corp., Livingston, NJ (United States)**	
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AC21-86MC22118	**Radian Corp., Austin, TX (United States)**	
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AC21-86MC23075	**Advanced Fuel Research, Inc., East Hartford, CT (United States)**	
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AC21-87MC23295	**Riley Stoker Corp., Worcester, MA (United States)**	
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AC22-86PC90275	**Combustion Engineering, Inc., Windsor, CT (United States)**	
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AC22-88ID12735	**MSE, Inc., Butte, MT (United States)**	
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AC22-88PC88858	**West Virginia Univ., Morgantown, WV (United States). Dept. of Physics**	
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AC22-89BC14470	**Texas Univ., Austin, TX (United States). Bureau of Economic Geology**	
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AC22-89BC14479	**Colorado Univ., Boulder, CO (United States). Dept. of Chemical Engineering**	
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AC22-89PC88400	**USDOE Pittsburgh Energy Technology Center, PA (United States)**	
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AC22-89PC89804	**TECOGEN, Inc., Waltham, MA (United States)**	
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AC22-90BC14650	**Texas Univ., Austin, TX (United States). Dept. of Petroleum Engineering**	
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AC22-90BC14657	**West Virginia Univ., Morgantown, WV (United States)**	
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AC22-90PC89865	**Air Products and Chemicals, Inc., Allentown, PA (United States)**	
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AC22-91PC91028	**Arkansas Univ., Fayetteville, AR (United States). Dept. of Chemical Engineering**	
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AC22-91PC91039	**SRI International, Menlo Park, CA (United States)**	
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AC22-91PC91154	**Foster Wheeler Development Corp., Livingston, NJ (United States)**	
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AC22-92BC14883	**Illinois Inst. of Tech., Chicago, IL (United States)**	
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AC22-92MT92011	**Texas Univ., Austin, TX (United States). Bureau of Economic Geology**	
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AC22-92MT92012	**Mission Research Corp., San Diego, CA (United States)**	
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AC22-92PC92112	**SRI International, Menlo Park, CA (United States)**	
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AC22-92PC92117	**Michigan Biotechnology Inst., Lansing, MI (United States)**	
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AI05-86ER60390	**National Inst. of Standards and Technology, Gaithersburg, MD (United States)**	
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AI05-91OR21971	**Army Engineer Waterways Experiment Station, Vicksburg, MS (United States). Geotechnical Lab.**	
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AM03-76SF00235	**Florida State Univ., Tallahassee, FL (United States). Dept. of Physics**	
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AS05-80ER10713	**Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (United States)**	
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BI79-84BP17460	**Oregon Dept. of Fish and Wildlife, John Day, OR (United States)**	
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FC01-91EI22627	**Massachusetts Executive Office of Consumer Affairs and Business Regulation, Boston, MA (United States). Div. of Energy Resources**	
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FC05-85ER25000	**Florida State Univ., Tallahassee, FL (United States). Supercomputer Computations Research Inst.**	
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FC08-90NV10872	**Nevada Univ., Las Vegas, NV (United States)**	
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	18:34646	DOE/ER/13190–8
FG02-84ER45162	Purdue Univ., Lafayette, IN (United States)	
	18:33154	DOE/ER/45162–T1
FG02-85ER13433	Minnesota Univ., Minneapolis, MN (United States). Dept. of Mechanical Engineering	
	18:33253	DOE/ER/13433–5
FG02-85ER45199	Purdue Univ., Lafayette, IN (United States)	
	18:34460	DOE/ER/45199–3
FG02-85ER60310	Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications	
	18:32439	NUREG/CP–0040
FG02-86ER13519	Cornell Univ., Ithaca, NY (United States)	
	18:34440	DOE/ER/13519–7
FG02-86ER13610	MCR Technology Corp., Chicago, IL (United States)	
	18:33862	CONF-8905192–4-App.A
FG02-86ER13617	Rensselaer Polytechnic Inst., Troy, NY (United States)	
	18:33321	DOE/ER/13617–T1
FG02-86ER13619	Marquette Univ., Milwaukee, WI (United States). Dept. of Chemistry	
	18:33322	DOE/ER/13619–7
FG02-86SF16306	Colorado State Univ., Fort Collins, CO (United States). Solar Energy Applications Lab.	
	18:32706	DOE/SF/16306–37
FG02-87ER13732	Pennsylvania Univ., Philadelphia, PA (United States)	
	18:33217	DOE/ER/13732–7
FG02-87ER13778	Western Michigan Univ., Kalamazoo, MI (United States)	
	18:34438	CONF-920948–14
	18:34439	CONF-920948–15
	18:34441	DOE/ER/13778–6
FG02-87ER40317	State Univ. of New York, Stony Brook, NY (United States)	
	18:33997	DOE/ER/40317–12
FG02-87ER45283	State Univ. of New York, Buffalo, NY (United States)	
	18:33254	DOE/ER/45283–12
FG02-87ER45326	Ohio State Univ. Research Foundation, Columbus, OH (United States)	
	18:33155	DOE/ER/45326–T3
FG02-87ER45328	Cornell Univ., Ithaca, NY (United States). Dept. of Materials Science and Engineering	
	18:33156	DOE/ER/45328–7
FG02-88ER40412	Purdue Univ., Lafayette, IN (United States). Dept. of Physics	
	18:34040	DOE/ER/40412–6
FG02-88ER40417	Brookhaven National Lab., Upton, NY (United States)	
	18:34064	BNL–49079
FG02-88ER45367	Michigan Univ., Ann Arbor, MI (United States)	
	18:33157	DOE/ER/45367–5
FG02-89ER12896	Argonne National Lab., Idaho Falls, ID (United States)	
	18:32356	ANL/FC/CP–77558
FG02-89ER40531	Kent State Univ., OH (United States). Dept. of Physics	
	18:34243	DOE/ER/40531–4
FG02-89ER52161	Rensselaer Polytechnic Inst., Troy, NY (United States)	
	18:33158	DOE/ER/52161–5
FG02-89ER53291	Wisconsin Univ., Madison, WI (United States). Dept. of Physics	
	18:34499	DOE/ER/53291–4
FG02-89ER60872	Ohio State Univ., Columbus, OH (United States). Dept. of Mechanical Engineering	
	18:32621	DOE/ER/60872–T2
FG02-89ER60898	MCR Technology Corp., Chicago, IL (United States)	
	18:33862	CONF-8905192–4-App.A
FG02-90ER12931	Virginia Univ., Charlottesville, VA (United States). Dept. of Mechanical, Aerospace and Nuclear Engineering	
	18:32798	DOE/ER/12931–2
FG02-90ER14153	Yale Univ., New Haven, CT (United States)	
	18:33971	DOE/ER/14153–3
FG02-90ER20008	Illinois Univ., Chicago, IL (United States)	
	18:33861	DOE/ER/20008–2
FG02-90ER20015	Boyce Thompson Inst. for Plant Research, Ithaca, NY (United States). Environmental Biology Dept.	
	18:33856	DOE/ER/20015–2

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FG02-90ER40553	Mount Holyoke Coll., South Hadley, MA (United States)	
	18:34154	DOE/ER/40553–4
FG02-90ER45426	Massachusetts Inst. of Tech., Cambridge, MA (United States)	
	18:33147	CONF-9211205–3
	18:33148	CONF-9211205–4
FG02-90ER61029	Clarkson Univ., Potsdam, NY (United States). Dept. of Chemistry	
	18:33961	DOE/ER/61029–14
FG02-91CE23810	Dayton Univ., OH (United States). Research Inst.	
	18:33291	DOE/CE/23810–10
	Trane Co., La Crosse, WI (United States)	
	18:33249	DOE/CE/23810–13-Vol.1
	18:33250	DOE/CE/23810–13-Vol.2
	18:33251	DOE/CE/23810–13-Vol.3
	National Inst. of Standards and Technology, Gaithersburg, MD (United States). Thermophysics Div.	
	18:33252	DOE/CE/23810–16
	Air-Conditioning and Refrigeration Technology Inst., Inc., Arlington, VA (United States)	
	18:33082	DOE/CE/23810–20
	Imagination Resources, Inc., Dublin, OH (United States)	
	18:33083	DOE/CE/23810–20C
FG02-91ER14228	Northwestern Univ., Evanston, IL (United States). Dept. of Chemistry	
	18:33338	DOE/ER/14228–2
FG02-91ER20055	Pennsylvania Univ., Philadelphia, PA (United States). Dept. of Biology	
	18:33857	DOE/ER/20055–4
FG02-91ER40676	Boston Univ., MA (United States). Dept. of Physics	
	18:34015	DOE/ER/40676–T1
FG02-91ER40678	Michigan State Univ., East Lansing, MI (United States)	
	18:33652	DOE/ER/40678–T1
FG02-91ER40682	Carnegie-Mellon Univ., Pittsburgh, PA (United States). Dept. of Physics	
	18:34024	DOE/ER/40682–23
FG02-91ER40684	Northwestern Univ., Evanston, IL (United States)	
	18:34016	DOE/ER/40684–3
FG02-91ER45460	Northwestern Univ., Evanston, IL (United States)	
	18:33255	DOE/ER/45460–2
FG02-91ER54109	Massachusetts Inst. of Tech., Cambridge, MA (United States). Plasma Fusion Center	
	18:34598	DOE/FTR–93017253
FG02-91ER54110	Massachusetts Inst. of Tech., Cambridge, MA (United States). Plasma Fusion Center	
	18:34592	DOE/FTR–93014001
	18:34597	DOE/FTR–93017252
FG02-91ER61235	Brandeis Univ., Waltham, MA (United States)	
	18:33858	DOE/ER/61235–T1
FG02-91ER61256	Michigan Univ., Ann Arbor, MI (United States). Dept. of Atmospheric and Oceanic Science	
	18:33914	DOE/ER/61256–T1
FG02-91ER75667	Nevada Univ., Las Vegas, NV (United States)	
	18:33007	DOE/ER/75667–1
FG02-92ER25122	Colorado Univ., Boulder, CO (United States). Dept. of Computer Science	
	18:34647	DOE/ER/25122–4
	18:34648	DOE/ER/25122–5
FG02-92ER30194	Argonne National Lab., IL (United States)	
	18:32757	ANL/ES/CP–80346
FG02-92ER40702	Tufts Univ., Medford, MA (United States)	
	18:34017	DOE/ER/40702–4
	Tufts Univ., Medford, MA (United States). Dept. of Physics and Astronomy	
	18:33998	DOE/ER/40702–3
FG02-92ER40704	Yale Univ., New Haven, CT (United States). Dept. of Physics	
	18:34018	DOE/ER/40704–2-Task-A
	18:34053	DOE/ER/40704–2-Task-J
FG02-92ER40730	Ames Lab., IA (United States)	
	18:34019	DOE/ER/40730–1
FG02-92ER40747	Indiana Univ., Bloomington, IN (United States)	
	18:33500	DOE/ER/40747–1
	Indiana Univ., Bloomington, IN (United States). Dept. of Physics	
	18:33501	DOE/ER/40747–3
	18:33502	DOE/ER/40747–4
	18:33503	DOE/ER/40747–7
FG02-92ER75748	Washington State Univ., Pullman, WA (United States)	
	18:32825	DOE/ER/75748–1
FG02-92ER75781	Illinois Univ., Urbana, IL (United States)	
	18:32817	DOE/ER/75781–1
FG03-87ER45324	California Univ., Santa Cruz, CA (United States)	
	18:34461	DOE/ER/45324–T3
FG03-90ER54089	Fusion Physics and Technology, Torrance, CA (United States)	
	18:34500	DOE/ER/54089–2
FG03-91ER81098	Argonne National Lab., IL (United States)	
	18:33554	ANL/PHY/CP–78215
FG03-92ER25117	Stanford Univ., CA (United States). Systems Optimization Lab.	
	18:34684	SOL–93-4
	18:34685	SOL–93-5
FG03-93ER40759	California Univ., San Diego, La Jolla, CA (United States). Dept. of Physics	
	18:33471	DOE/ER/40759–1
FG04-84ER45099	Pacific Northwest Lab., Richland, WA (United States)	
	18:33277	PNL-SA–22730
FG05-80ET53088	Texas Univ., Austin, TX (United States). Inst. for Fusion Studies	
	18:34502	DOE/ET/53088–546
	18:34503	DOE/ET/53088–609
	18:34504	DOE/ET/53088–616
FG05-84ER13263	North Carolina Univ., Charlotte, NC (United States). Dept. of Chemistry	
	18:33320	DOE/ER/13263–T1
FG05-84ER40162	Georgia State Univ., Atlanta, GA (United States). Dept. of Physics and Astronomy	
	18:33651	DOE/ER/40162–T6
FG05-86ER40270	George Washington Univ., Washington, DC (United States). Center for Nuclear Studies	
	18:34066	DOE/ER/40270–42
FG05-86ER40285	George Washington Univ., Washington, DC (United States). Dept. of Physics	
	18:34061	DOE/ER/40285–6
	18:34062	DOE/ER/40285–T2
FG05-87ER40309	Brookhaven National Lab., Upton, NY (United States)	
	18:33572	BNL–52321
FG05-87ER40319	Florida State Univ., Tallahassee, FL (United States)	
	18:33650	CONF-9209263–14

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	Florida State Univ., Tallahassee, FL (United States). Dept. of Physics	
	18:34014	DOE/ER/40319–T3
	18:34022	CONF-9209321–1
	Florida State Univ., Tallahassee, FL (United States). Supercomputer Computations Research Inst.	
	18:34455	CONF-9302137–1
FG05-87ER52141	**Georgia Inst. of Tech., Atlanta, GA (United States)**	
	18:34506	GTFR–108
FG05-88ER13859	**Tennessee Univ., Knoxville, TN (United States). Dept. of Chemistry**	
	18:33323	DOE/ER/13859–32
FG05-91ER40619	**Lawrence Livermore National Lab., CA (United States)**	
	18:34412	UCRL-JC–113668
FG05-91ER61226	**Texas Univ., Houston, TX (United States). Cancer Center**	
	18:33864	DOE/ER/61226–2
FG05-91OR21981	**Tennessee Dept. of Health, Nashville, TN (United States)**	
	18:32554	DOE/OR/21981–T1
FG05-92ER14295	**Rice Univ., Houston, TX (United States)**	
	18:33324	DOE/ER/14295–1
FG05-92ER40739	**Texas Univ., Austin, TX (United States). Dept. of Physics**	
	18:34444	DOE/ER/40739–1
FG06-89ER75522	**Pacific Northwest Lab., Richland, WA (United States)**	
	18:33386	PNL-SA–21767
FG06-90ER40541	**Washington Univ., Seattle, WA (United States). Dept. of Physics**	
	18:33582	DOE/ER/40541–1
FG06-90ER40561	**Washington Univ., Seattle, WA (United States)**	
	18:34063	DOE/ER/40561–110-INT93
FG06-91ER40614	**Argonne National Lab., IL (United States)**	
	18:33987	ANL-HEP-CP–93-39
FG08-85NV10461	**Nevada Nuclear Waste Project Office, Carson City, NV (United States)**	
	18:32461	NWPO-TR–016-91
FG21-89MC26031	**New Mexico Inst. of Mining and Technology, Socorro, NM (United States). New Mexico Petroleum Recovery Research Center**	
	18:32272	DOE/MC/26031–3442
FG21-91MC28080	**West Virginia Univ., Morgantown, WV (United States). Coll. of Engineering**	
	18:32315	DOE/MC/28080–3381
	18:32316	DOE/MC/28080–3382
FG21-92MC29228	**Lehigh Univ., Bethlehem, PA (United States). Zettlemoyer Center for Surface Studies**	
	18:32675	DOE/MC/29228–3407
	18:33325	DOE/MC/29228–3408
FG22-87PC79916	**Kentucky Univ., Lexington, KY (United States). Dept. of Mechanical Engineering**	
	18:32228	DOE/PC/79916–3
FG22-88PC88921	**Illinois Univ., Urbana, IL (United States)**	
	18:32187	DOE/PC/88921–16
FG22-89BC14445	**Texas Univ., Austin, TX (United States). Dept. of Petroleum Engineering**	
	18:32256	DOE/BC/14445–12
FG22-89PC89776	**Northeastern Univ., Boston, MA (United States). Dept. of Mechanical Engineering**	
	18:32210	CONF-910442–2
	18:32211	CONF-930413–2
FG22-89PC89778	**Minnesota Univ., Minneapolis, MN (United States). Mineral Resources Research Center**	
	18:32761	DOE/PC/89778–T9
	Minnesota Univ., St. Paul, MN (United States). Inst. of Technology	
	18:32230	DOE/PC/89778–T11
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FG22-89PC89785	**Lehigh Univ., Bethlehem, PA (United States). Dept. of Chemistry**	
	18:33326	DOE/PC/89785–14
FG22-89PC89786	**Pittsburgh Univ., PA (United States). Dept. of Chemical and Petroleum Engineering**	
	18:32676	DOE/PC/89786–T17
FG22-90BC14600	**Stanford Univ., CA (United States). Petroleum Research Inst.**	
	18:32257	DOE/BC/14600–51
	18:32259	DOE/BC/14600–53
	University of Southern California, Los Angeles, CA (United States). Dept. of Chemical Engineering	
	18:32258	DOE/BC/14600–52
FG22-90PC90293	**Georgia Inst. of Tech., Atlanta, GA (United States). School of Chemical Engineering**	
	18:32163	DOE/PC/90293–T9
FG22-90PC90308	**Brown Univ., Providence, RI (United States). Div. of Engineering**	
	18:32189	DOE/PC/90308–9
	18:32190	DOE/PC/90308–10
FG22-90PC90309	**Tennessee Univ., Tullahoma, TN (United States). Space Inst.**	
	18:32762	DOE/PC/90309–11
FG22-91BC14818	**Interstate Oil and Gas Compact Commission, Oklahoma City, OK (United States)**	
	18:32262	DOE/BC/14818–1(Vol.1)
	18:32263	DOE/BC/14818–2(Vol.2)
FG22-91PC91283	**Tuskegee Univ., AL (United States). Dept. of Chemical Engineering**	
	18:32184	CONF-930413–3
FG22-91PC91284	**Stanford Univ., CA (United States). Dept. of Civil Engineering**	
	18:32249	DOE/PC/91284–6
FG22-91PC91288	**Georgia Inst. of Tech., Atlanta, GA (United States). School of Chemical Engineering**	
	18:32166	DOE/PC/91288–T8
FG22-91PC91292	**USDOE Pittsburgh Energy Technology Center, PA (United States)**	
	18:32235	DOE/PC/91292–T7
FG22-91PC91295	**Michigan Univ., Ann Arbor, MI (United States). Dept. of Chemical Engineering**	
	18:32201	DOE/PC/91295–T7
FG22-91PC91296	**New Mexico Univ., Albuquerque, NM (United States). Center for Micro-Engineered Ceramics**	
	18:32191	DOE/PC/91296–7
FG22-91PC91298	**Clarkson Univ., Potsdam, NY (United States). Dept. of Chemical Engineering**	
	18:33327	DOE/PC/91298–7
FG22-91PC91301	**Lehigh Univ., Bethlehem, PA (United States)**	
	18:33328	DOE/PC/91301–7
FG22-91PC91310	**University of Wyoming Research Corp., Laramie, WY (United States). Western Research Inst.**	
	18:32167	DOE/PC/91310–T6
FG22-92BC14853	**Oklahoma Geological Survey, Norman, OK (United States)**	
	18:32264	DOE/BC/14853–4

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FG22-92PC92535	**Northeastern Univ., Boston, MA (United States)**	
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W-31-109-ENG-38	**Argonne National Lab., IL (United States)**	
	18:33143	ANL/ET/CP–78882
W-31109-ENG-38	**Argonne National Lab., Idaho Falls, ID (United States)**	
	18:32356	ANL/FC/CP–77558
	Argonne National Lab., IL (United States)	
	18:32134	ANL/CHM/CP–75097
	18:32183	ANL/CHM/CP–76129
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	18:32354	ANL/CHM/CP–79536
	18:32355	ANL/EWM/CP–80486
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	18:32602	PATENTS-US–A7746537
	18:32620	ANL/IPNS/CP–79155
	18:32679	ANL/EAIS/CP–80295
	18:32748	ANL/EP/CP–79808
	18:32757	ANL/ES/CP–80346
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	18:32905	ANL/RE/CP–78655
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	18:33117	ANL/EAIS/TM–101
	18:33144	ANL/MSD/CP–79243
	18:33211	ANL/ET/CP–77180
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	18:33288	ANL/MSD/CP–79154
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	18:33347	ANL/RE–93/5
	18:33348	ANL/RE/CP–78822
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	18:33460	ANL/APS/IN/VIB–92/4
	18:33461	ANL/EP/CP–78374
	18:33462	ANL-HEP-CP–93-42
	18:33463	ANL-HEP-CP–93-43
	18:33490	ANL/ASD/CP–78300
	18:33491	ANL/ASD/CP–78331
	18:33492	ANL/ASD/CP–78334
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	18:34697	ANL/MCS/CP–80152
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	Oak Ridge National Lab., TN (United States)	
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	Nuclear Regulatory Commission, Washington, DC (United States). Div. of Engineering	
	18:32807	NUREG/CR–4744-Vol.7-No.2
	USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). RCRA/CERCLA Div.	
	18:32362	DOE/EH–0330
	USDOE Oak Ridge Field Office, TN (United States)	
	18:32541	DOE/EIS–0185F-387
W-7405-ENG-36	**Argonne National Lab., IL (United States)**	
	18:34237	ANL/EP/CP–79781
	Sandia National Labs., Albuquerque, NM (United States)	
	18:32611	SAND–93-1678C
	Los Alamos National Lab., NM (United States)	
	18:32418	LA-SUB–93-258
	18:32419	LA-UR–93-2171
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	18:32427	LA-UR–93-2761
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78721	18:33242	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019024	MF-900
78882	18:33143	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017733	MF-404
78928	18:34486	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018615	MF-367
78942	18:33214	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018577	MF-404
80302	18:34487	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018624	MF-310
ANL/EWM/CP–					
80486	18:32355	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019019	MF-902

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ANL/FC/CP–					
77558	18:32356	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017444	MF-902
ANL/IPNS/CP–					
78911	18:33550	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017797	MF-406
78912	18:33551	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017798	MF-413
79155	18:32620	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017795	MF-406
79156	18:33646	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017796	MF-404
ANL/MCS-TM–					
177	18:34643	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018398	MF-405
ANL/MCS/CP–					
80151	18:34641	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017412	MF-405
80152	18:34697	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017413	MF-405
80307	18:34642	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017752	MF-405
ANL/MCT/CP–					
76064	18:33422	OSTI; NTIS; GPO Dep.	E 1.99:	DE93015159	MF-115
78646	18:33215	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017405	MF-310
ANL/MSD/CP–					
79154	18:33288	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017746	MF-406
79243	18:33144	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018575	MF-404; MF-411
79602	18:34453	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017475	MF-404
79845	18:33243	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017690	MF-404
80248	18:33244	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017404	MF-404
80258	18:33216	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017403	MF-404
80489	18:34485	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019018	MF-404
ANL/NDM–					
128	18:34644	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018400	MF-413
ANL/PHY/CP–					
78090	18:33495	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017538	MF-414
78195	18:33552	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018567	MF-413
78214	18:33553	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017426	MF-413
78215	18:33554	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017427	MF-413
80056	18:34036	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017422	MF-414
80101	18:33636	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017449	MF-414
ANL/RE–					
93/2	18:32799	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018048	MF-506
93/3	18:33346	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018933	MF-506
93/5	18:33347	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018399	MF-506
93/7	18:33245	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040384	MF-506
ANL/RE/CP–					
78655	18:32905	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018992	MF-1006
78807	18:32906	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019022	
78822	18:33348	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019541	MF-506
80363	18:32907	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018588	MF-506
ANL/XFD/CP–					
78532	18:33555	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017687	MF-411
78584	18:33556	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019753	MF-411
AUC-IBT-R–					
9318	18:32737	OSTI; NTIS		DE93525271	
BHARC–					
700/93/029-Vol.3	18:32927	*See* NUREG/CR–5758-Vol.3			
BHR–					
71	18:33647	OSTI; NTIS; INIS		DE94600289	
BNL–					
34518-Ed.9	18:34013	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019826	MF-414
48231	18:33557	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014304	MF-414
48259	18:33464	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017610	MF-414
48458	18:32731	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018823	MF-255; MF-402
48554	18:32584	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018671	MF-400
48555	18:32585	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018669	MF-400
48556	18:32586	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019043	MF-406
48563	18:33692	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019044	MF-400
48581	18:33128	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018672	MF-400
48749	18:33798	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019471	MF-902; MF-940
48750	18:32357	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019470	MF-902; MF-940
48805	18:33454	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019469	MF-400
49016	18:33648	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016132	MF-406

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49017	18:33690	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016133	MF-406
49079	18:34064	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017577	MF-413
49092	18:33246	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016748	MF-410
49134	18:33753	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018385	MF-402
49141	18:33558	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017707	MF-414
49158	18:32994	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018383	MF-607
49160	18:33649	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017590	MF-406
49162	18:33799	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018384	MF-602
49166	18:33637	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017611	MF-414
49167	18:33638	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017612	MF-414
49169	18:33559	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017573	MF-414
49173	18:33560	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017575	MF-414
49175	18:33561	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017574	MF-414
49193	18:32154	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017608	MF-402
49194	18:33970	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018460	MF-403
49212	18:33496	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019924	MF-414
49213	18:33465	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018674	MF-414
49247	18:33743	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018847	MF-400
49264	18:33562	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018822	MF-414
49276	18:33497	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019059	MF-400
49283	18:33754	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018815	MF-402
49295	18:32358	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018824	MF-525
49307	18:33563	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018825	MF-406
49336	18:34153	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019846	MF-400
49345	18:33247	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040015	MF-404
49351	18:32255	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040033	MF-402
49436	18:33498	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040383	MF-414
52300-Rev.10/92	18:34627	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017985	MF-900
52340	18:33077	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018814	MF-350
52382	18:34528	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019776	PC-731
70084	18:34065	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93018255	MF-413
70331	18:33800	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014310	MF-408
70341	18:33755	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014798	MF-402
70343	18:34458	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014797	MF-400
BNL-NUREG–					
48663	18:32816	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013170	
51708-Vol.7	18:32926	*See* NUREG/CR–3469-Vol.7			
52377	18:32930	*See* NUREG/CR–6049			
BUP–					
1992-01	18:34037	OSTI; NTIS; INIS		DE94600369	
1992-04	18:34454	OSTI; NTIS; INIS		DE94600533	
1992-06	18:34038	OSTI; NTIS; INIS		DE94600370	
1992-11	18:34220	OSTI; NTIS; INIS		DE94600402	
1992-13	18:34238	OSTI; NTIS; INIS		DE94600422	
1992-14	18:34239	OSTI; NTIS; INIS		DE94600423	
1992-15	18:34030	OSTI; NTIS; INIS		DE94600365	
1992-16	18:34240	OSTI; NTIS; INIS		DE94600421	
CEA-CONF–					
11207	18:33057	OSTI; NTIS (US Sales Only)		DE93515348	
11310	18:33145	OSTI; NTIS (US Sales Only)		DE93515323	
CEBAF-PR–					
93-004	18:33578	*See* DOE/ER/40150–220			
93-005	18:33577	*See* DOE/ER/40150–219			
93-017	18:33575	*See* DOE/ER/40150–211			
93-018	18:33576	*See* DOE/ER/40150–212			
93-020	18:34488	*See* DOE/ER/40150–214			
93-023	18:33581	*See* DOE/ER/40150–T2			
93-024	18:33579	*See* DOE/ER/40150–224			
93-029	18:33580	*See* DOE/ER/40150–226			
93-030	18:33499	*See* DOE/ER/40150–227			
93-031	18:34052	*See* DOE/ER/40150–223			
CMU-HEP–					
92-01	18:34024	*See* DOE/ER/40682–23			
CNDC–					
0009	18:34415	*See* CNIC–00645			
CNIC–					
00645	18:34415	OSTI; NTIS (US Sales Only); INIS		DE93633241	
CNWRA–					
92-011	18:32460	*See* NUREG/CR–6021			
92-02S-Vol.3-No.2	18:32459	*See* NUREG/CR–5817-Vol.3-No.2			

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CONF-761043–		(20. annual conference of analytical chemistry; Gatlinburg, TN (United States); 11-14 Oct 1976)			
1	18:33854	*See* Y–2073/R1			
CONF-8903283–		(Transuranic waste technology development international technology exchange program conference; 1. U.S. Department of Energy (DOE)/Power Reactor and Nuclear Fuel Development Corporation of Japan (PNC) bilateral coordination meeting on radioactive waste mana; Mito (Japan); Augusta, GA (United States); 17-20 Oct 1989; 7-9 mar 1989)			
Summ.	18:32359	*See* CONF-8910364–Vol.2			
CONF-8905192–		(Conference on X-ray microimaging for the life sciences; Berkeley, CA (United States); 24-26 May 1989)			
4-App.A	18:33862	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017913	MF-408
CONF-8910364–		(Transuranic waste technology development international technology exchange program conference; 1. U.S. Department of Energy (DOE)/Power Reactor and Nuclear Fuel Development Corporation of Japan (PNC) bilateral coordination meeting on radioactive waste mana; Mito (Japan); Augusta, GA (United States); 17-20 Oct 1989; 7-9 mar 1989)			
Vol.2	18:32359	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93016513	MF-721
CONF-891136–		(9. international workshop on laser interaction and related plasma phenomena; Monterey, CA (United States); 6-10 Nov 1989)			
3	18:34437	*See* UCRL-JC–113605			
CONF-9005247–		(International conference on radiation material science; Alushta (USSR); 22-25 May 1990)			
	18:32803	*See* INIS-mf–13548			
	18:32804	*See* INIS-mf–13549			
CONF-9006446–		(MUSE HT 90: Conference on efficient end uses of electricity in the building sector; Sophia Antipolis (France); 12-13 Jun 1990)			
	18:33063	*See* AFME–90-04-DOC			
CONF-9007258–		(Seminar on Solar thermal utilization; Sophia-Antipolis (France); 4-5 Jul 1990)			
	18:32699	*See* ADEME–90-04-DOC			
CONF-9009123–		(13. international conference on plasma physics and controlled nuclear fusion research; 1990 Linear accelerator conference; Symposium on detector research and development for the Superconducting Super Collider; Washington, DC (United States); Albuquerque, NM (United States); Fort Worth, TX (United States); 1-6 Oct 1990; 9-14 sep 1990; 15-18 oct 1990)			
	18:33685	*See* TRI-PP–90-72			
CONF-9009332–		(Conference on particle production near threshold; Nashville, IN (United States); 30 Sep - 3 oct 1990)			
	18:34051	*See* TRI-PP–90-71			
CONF-9010212–		(13. international conference on plasma physics and controlled nuclear fusion research; 1990 Linear accelerator conference; Symposium on detector research and development for the Superconducting Super Collider; Washington, DC (United States); Albuquerque, NM (United States); Fort Worth, TX (United States); 1-6 Oct 1990; 9-14 sep 1990; 15-18 oct 1990)			
	18:33685	*See* TRI-PP–90-72			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-901025–		(13. international conference on plasma physics and controlled nuclear fusion research; 1990 Linear accelerator conference; Symposium on detector research and development for the Superconducting Super Collider; Washington, DC (United States); Albuquerque, NM (United States); Fort Worth, TX (United States); 1-6 Oct 1990; 9-14 sep 1990; 15-18 oct 1990)			
	18:33685	*See* TRI-PP–90-72			
CONF-9103277–		(KEK FEL simulation code workshop; Tsukuba (Japan); 15 Mar 1991)			
	18:33506	*See* KEK-PROC–92-12			
CONF-910442–		(16. international conference on coal and slurry technologies; Clearwater, FL (United States); 22-25 Apr 1991)			
2	18:32210	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017256	MF-104
CONF-9109152–		(Oil heat technology conference and workshop; Upton, NY (United States); 30 Sep - 1 oct 1991)			
	18:33077	*See* BNL–52340			
CONF-9110496–		(Air quality management programs: a workshop on lessons learned; Morelos (Mexico); 16-19 Oct 1991)			
	18:33769	*See* LA–12571-C			
CONF-9110513–		(Colloquium on new data on the use of energy from wood; Paris (France); 15-16 Oct 1991)			
	18:32646	*See* ADEME–91-01-DOC-2			
CONF-911106–		(1991 Institute of Electrical and Electronic Engineers (IEEE) nuclear science symposium and medical imaging conference; Santa Fe, NM (United States); 2-9 Nov 1991)			
103	18:33679	*See* LA-UR–91-3572			
CONF-911107–		(1991 winter meeting of the American Nuclear Society (ANS); San Francisco, CA (United States); 10-15 Nov 1991)			
84	18:32343	*See* DOE/WIPP–91-027C			
CONF-9111328–		(Colloquium on biomass: an energy source for the quality of environment; Paris (France); 27-28 Nov 1991)			
	18:32635	*See* ADEME–91-01-DOC-1			
CONF-911268–		(CERS '91: Chinese experts radwaste symposium; Taipei (China); 17-18 Dec 1991)			
3	18:32397	*See* DOE/WIPP–91-033C			
CONF-9202186–		(3. workshop on Japan Linear Collider (JLC); Tsukuba (Japan); 18-20 Feb 1992)			
	18:33479	*See* KEK-PROC–92-13			
CONF-9202187–		(Meeting on engineering and technology in basic research; Tsukuba (Japan); 6-7 Feb 1992)			
	18:33456	*See* KEK-PROC–92-5			
CONF-920307–		(Waste management '92; Tucson, AZ (United States); 1-5 Mar 1992)			
94	18:33828	*See* UCRL-JC–109902			
97	18:32399	*See* DOE/WIPP–91-040C			
99	18:32402	*See* DOE/WIPP–92-006C			
Extd.Abst.	18:32400	*See* DOE/WIPP–91-045C			
CONF-920315–		(EPAC 92: 3. European particle accelerator conference: accelerators for special applications; Berlin (Germany); 24-28 Mar 1992)			
48	18:33500	*See* DOE/ER/40747–1			
CONF-920403–		(94. annual general meeting of the Canadian Institute of Mining and Metallurgy; Montreal (Canada); 24 Apr 1992)			
1	18:32398	*See* DOE/WIPP–91-038C			
CONF-920444–		(203. American Chemical Society (ACS) national meeting; San Francisco, CA (United States); 5-10 Apr 1992)			
39	18:32134	*See* ANL/CHM/CP–75097			
CONF-9206234–		(International conference on advances in corrosion and protection; Manchester (United Kingdom); 28 Jun - 3 jul 1992)			
3	18:33159	*See* ETDE-IT–93-205			

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CONF-920634–		(33. US symposium on rock mechanics; Santa Fe, NM (United States); 3-10 Jun 1992)			
12	18:32404	*See* DOE/WIPP–92-014C			
CONF-9206358–		(3. international conference on mathematical population dynamics; Pau (France); 1-5 Jun 1992)			
[illegible]	18:33845	*See* ETDE-IT–93-206			
CONF-920673–		(16. annual symposium of American Society of Testing and Materials (ASTM) on effects of radiation on materials; Denver, CO (United States); 21-25 Jun 1992)			
23	18:33146	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017858	MF-404
CONF-9207122–		(The Fine Particle Society conference; Las Vegas, NV (United States); 14 Jul 1992)			
[illegible]	18:32403	*See* DOE/WIPP–92-009C			
CONF-920720–		(International conference on low dose irradiation and biological defense mechanisms; Kyoto (Japan); 12-16 Jul 1992)			
[illegible]	18:33920	*See* ETDE-IT–93-201			
CONF-9207216–		(2. EGS4 user's meeting in Japan; Tsukuba (Japan); 20-22 Jul 1992)			
	18:34660	*See* KEK-PROC–92-16			
CONF-920799–		(Review of progress in quantitative nondestructive evaluation (NDE); La Jolla, CA (United States); 19-24 Jul 1992)			
[illegible]	18:33422	*See* ANL/MCT/CP–76064			
CONF-920815–		(204. American Chemical Society (ACS) national meeting; Washington, DC (United States); 23-28 Aug 1992)			
25	18:32354	*See* ANL/CHM/CP–79536			
26	18:32183	*See* ANL/CHM/CP–76129			
CONF-9208188–		(North Atlantic Treaty Organization/Advanced Studies Institute (NATO/ASI) summer school: from statistical physics to statistical inference and back; Cargese (France); 31 Aug - 12 sep 1992)			
[illegible]	18:34445	*See* UCRL-JC–113768			
CONF-920823–		(22. Department of Energy (DOE)/Nuclear Regulatory Commission (NRC) nuclear air cleaning and treatment conference; Denver, CO (United States); 24-27 Aug 1992)			
Vol.1	18:32820	*See* NUREG/CP–0130-Vol.1			
Vol.2	18:32821	*See* NUREG/CP–0130-Vol.2			
CONF-920847–		(International conference on hadron spectroscopy; College Park, MD (United States); 12-16 Aug 1992)			
[illegible]	18:34042	*See* FNAL/C–93/088			
CONF-920913–		(14. international conference on plasma physics and controlled nuclear fusion research; Wurzburg (Germany); 30 Sep - 7 oct 1992)			
32	18:34520	*See* UCRL-JC–109884			
33	18:34604	*See* ETDE-IT–93-207			
CONF-9209226–		(American Chemical Society (ACS) special symposium on emerging technologies in hazardous waste management; Atlanta, GA (United States); 21-23 Sep 1992)			
4-Extd.Abst.	18:32405	*See* DOE/WIPP–92-044C			
CONF-9209263–		(3. international conference on calorimetry in high energy physics; Corpus Christi, TX (United States); 29 Sep - 2 oct 1992)			
14	18:33650	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018268	MF-414
CONF-9209295–		(Society of Photo Optical Instrumentation Engineers (SPIE/EOS) international symposium on optical design systems; Berlin (Germany); 14-19 Sep 1992)			
2	18:33437	*See* ETDE-IT–93-204			
CONF-9209321–		(23. Workshop of the INFN Eloisatron Project "Properties of SUSY Particles"; Erice (Italy); 28 Sep - 4 oct 1992)			
1	18:34022	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018270	MF-414

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CONF-9209381–		(The urban perspective of acid rain; Raleigh, NC (United States); 23-24 Sep 1992)			
Summ.	18:33778	*See* ORNL/M–2936			
CONF-9209383–		(Congress on Solid State Ionics; Villard de Lans (France); 7-11 Sep 1992)			
1	18:33057	*See* CEA-CONF–11207			
CONF-920947–		(Conference on nanostructured materials; Cancun (Mexico); 21-25 Sep 1992)			
6	18:33243	*See* ANL/MSD/CP–79845			
CONF-920948–		(6. international conference on physics of highly charged ions; Manhattan, KS (United States); 28 Sep - 2 oct 1992)			
14	18:34438	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018776	MF-411
15	18:34439	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018778	MF-411
CONF-920967–		(Advanced research workshop on non-thermal plasma techniques for pollution control; Cambridge (United Kingdom); 21-25 Sep 1992)			
4	18:32769	*See* UCRL-JC–111556			
CONF-9210173–		(Nuclear Energy Agency Science Committee (NEANSC) specialists meeting on evaluation and processing of covariance data; Oak Ridge, TN (United States); 7-9 Oct 1992)			
7	18:34241	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018459	MF-505
CONF-9210351–		(The mining town of Pribram in science and technology; Pribram (Czechoslovakia); 12-14 Oct 1992)			
	18:32533	*See* INIS-mf–13676			
CONF-9210372–		(Workshop on the rational use of energy; Budapest (Hungary); 27-29 Oct 1992)			
4	18:33118	*See* ETDE-IT–93-200			
CONF-921049–		(Windpower '92; Seattle, WA (United States); 19-23 Oct 1992)			
10	18:32964	*See* PNL-SA–22609			
CONF-921068–		(East-West topical meeting: the safe and reliable operation of light water reactor NPP's; Prague (Czechoslovakia); 18-21 Oct 1992)			
	18:32919	*See* KFKI–1992-33/G			
CONF-921101–		(16. Materials Research Society fall meeting; Boston, MA (United States); 30 Nov - 5 dec 1992)			
138	18:34494	*See* ETDE-IT–93-203			
CONF-9211185–		(RCNP Kikuchi school on spin physics at intermediate energies; Osaka (Japan); 16-19 Nov 1992)			
2	18:33502	*See* DOE/ER/40747–4			
CONF-9211205–		(High-temperature ordered intermetallic alloys V; Boston, MA (United States); 30 Nov - 3 dec 1992)			
3	18:33147	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018331	MF-404
4	18:33148	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018332	MF-404
CONF-9211249–		(2. international symposium on DNA fingerprinting; Belo Horizonte (Brazil); 9 Nov 1992)			
1	18:33966	*See* UCRL-JC–112318			
CONF-921131–		(10. international symposium on high-energy spin physics; Nagoya (Japan); 9-14 Nov 1992)			
13	18:33501	*See* DOE/ER/40747–3			
CONF-921145–		(Production and neutralization of negative ions and beams; Upton, NY (United States); 9-13 Nov 1992)			
9	18:33631	*See* UCRL-JC–112224			
CONF-921256–		(1992 international conference on lasers; Houston, TX (United States); 7-11 Dec 1992)			
7	18:33202	*See* UCRL-JC–111666			
CONF-921289–		(Workshop on research opportunities in plant biochemistry; Kona, HI (United States); 11-13 Dec 1992)			
Summ.	18:32640	*See* DOE/ER–93017838			
CONF-930102–		(IEEE Power Engineering Society winter meeting; Columbus, OH (United States); 31 Jan - 4 feb 1993)			
1	18:32958	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018404	MF-222

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-930103--		(10. symposium on space nuclear power and propulsion; Albuquerque, NM (United States); 10-14 Jan 1993)			
43	18:32788	*See* SAND-93-1263C			
CONF-9301109--		(2. international conference on physics and astrophysics of quark-gluon plasma; Calcutta (India); 19-23 Jan 1993)			
4	18:34242	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018719	MF-413
CONF-9301114--		(John M. Crowley symposium on ultramicroscopy; Scottsdale, AZ (United States); 5-8 Jan 1993)			
2	18:33204	*See* UCRL-JC-112438			
CONF-9301123--		(1. scientific workshop on results of the R/V Mt. Mitchell cruise; Kuwait City (Kuwait); 24-28 Jan 1993)			
1	18:33970	*See* BNL-49194			
CONF-9301125--		(Los Alamos Technology Exchange workshop on dynamic response of materials to pulsed heating; Los Alamos, NM (United States); 22-25 Jan 1993)			
2	18:33282	*See* SAND-93-1661C			
CONF-930130--		(26. Health Physics Society midyear topical meeting on environmental health physics; Coeur d'Alene, ID (United States); 24-28 Jan 1993)			
17	18:32536	*See* WINCO-11913			
CONF-930159--		(OE/LASE '93: International Society for Optical Engineering (SPIE) conference; Los Angeles, CA (United States); 16-23 Jan 1993)			
36	18:34436	*See* UCRL-JC-113498			
48	18:34522	*See* UCRL-JC-113179			
50	18:34435	*See* UCRL-JC-112950			
53	18:32618	*See* UCRL-JC-110971			
53	18:33289	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017776	MF-401
CONF-930164--		(17. annual conference on composites and advanced ceramics; Cocoa Beach, FL (United States); 11-15 Jan 1993)			
13	18:33211	*See* ANL/ET/CP-77180			
CONF-930168--		(Simulating accelerator radiation environments workshop; Santa Fe, NM (United States); 11-15 Jan 1993)			
7	18:34411	*See* UCRL-JC-113180			
CONF-930169--		(16. nuclear physics symposium; Oaxtepec (Mexico); 5-8 Jan 1993)			
3	18:34049	*See* LBL-34241			
CONF-930195--		(2. Nassau Moessbauer conference; Garden City, NY (United States); 8 Jan 1993)			
3	18:33556	*See* ANL/XFD/CP-78584			
CONF-930202--		(Annual meeting of the Metallurgical Society; Denver, CO (United States); 21-25 Feb 1993)			
11	18:33149	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018457	MF-404
CONF-930205--		(Waste management '93; Tucson, AZ (United States); 28 Feb - 4 mar 1993)			
	18:33909	*See* AEA-D and R-0503			
48	18:32571	*See* PNL-SA-22046			
74	18:32517	*See* WINCO-11918			
79	18:32356	*See* ANL/FC/CP-77558			
80	18:32466	*See* PNL-SA-21514			
Pt.1	18:32510	*See* WHC-MR-0413			
CONF-9302103--		(Annual meeting of the Minerals, Metals and Materials Society (TMS); Denver, CO (United States); 21-25 Feb 1993)			
3	18:33349	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017853	MF-406
4	18:33240	*See* UCRL-JC-111591			
CONF-9302135--		(Institute for Electronic and Electrical Engineers (IEEE) COMPON spring meeting; San Francisco, CA (United States); 22-26 Feb 1993)			
1	18:34688	*See* UCRL-JC-112573			
2	18:34645	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017764	MF-405

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CONF-9302137–		(6. annual workshop on recent developments in computer simulation studies in condensed matter physics; Athens, GA (United States); 22-26 Feb 1993)			
1	18:34455	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018269	MF-414
CONF-9302140–		(Extension of the treaty on non-proliferation of nuclear weapons: issues for 1995; Cambridge, MA (United States); 11-12 Feb 1993)			
Summ.	18:33130	*See* UCRL-JC–113936			
CONF-930217–		(Field application of foams for oil production; Bakersfield, CA (United States); 11-12 Feb 1993)			
	18:32275	*See* NIPER–669			
CONF-930241–		(11. international modal analysis conference; Kissimmee, FL (United States); 1-4 Feb 1993)			
2	18:33401	*See* UCRL-JC–110987			
CONF-930269–		(Computational accelerator physics conference (CAP93); Pleasanton, CA (United States); 22-26 Feb 1993)			
16	18:33632	*See* UCRL-JC–112245			
18	18:33516	*See* UCRL-JC–112263			
19	18:33515	*See* UCRL-JC–111188			
CONF-930274–		(Workshop on traps for antimatter and radioactive nuclei; Vancouver (Canada); 25-27 Feb 1993)			
4	18:34471	*See* PNL-SA–21961			
CONF-930293–		(International symposium on 30 years of neutral currents; Los Angeles, CA (United States); 3-5 Feb 1993)			
4	18:34011	*See* UCRL-JC–113747			
CONF-930304–		(205. American Chemical Society national meeting; Denver, CO (United States); 28 Mar - 2 apr 1993)			
31	18:33203	*See* UCRL-JC–112347			
CONF-9303105–		(1993 federal environmental restoration conference; Washington, DC (United States); 25-27 Mar 1993)			
2	18:33041	*See* UCRL-JC–113664			
CONF-9303126–		(4. international workshop on the physics of compressible turbulent mixing; Cambridge (United Kingdom); 29 Mar - 1 apr 1993)			
8	18:34620	*See* UCRL-JC–112167			
CONF-9303131–		(Cray Users Group conference; Montreaux (Switzerland); 29 Mar - 2 apr 1993)			
2-Vugraphs	18:34690	*See* UCRL-JC–113561			
CONF-9303141–		(Department of Energy's (DOE) international safeguard meeting; Vienna (Austria); 22-23 Mar 1993)			
2	18:32604	*See* PNL-SA–22130			
CONF-9303158–		(International Atomic Energy Agency (IAEA) consultant's meeting; Vienna (Austria); 30 Mar - 2 apr 1993)			
2	18:32603	*See* PNL-SA–22129			
CONF-9303171–		(28. Recontres de Moriond conference on electroweak interaction and unified theories; Les Arcs (France); 13-20 Mar 1993)			
5	18:34031	*See* FNAL/C–93/163-E			
CONF-9303187–		(DOE radiation protection workshop; Asia and Pacific Basin Regional Congress on radiation protection; Las Vegas, NV (United States); Beijing (China); Mar 1993; 18-22 oct 1993)			
1	18:33956	*See* SAND–93-0761C			
CONF-9303190–		(International symposium on advanced nuclear energy research - neutrons as microscopic probes; Mito Ibaraki (Japan); 10-12 Mar 1993)			
3	18:33246	*See* BNL–49092			

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CONF-9303198–		(National Center for Advanced Information Components Manufacturing (NCAICM) workshop; Albuquerque, NM (United States); 30-31 Mar 1993)			
4	18:33450	*See* UCRL-JC–113651			
CONF-9303203–		(SUSY 93 workshop; Boston, MA (United States); 29 Mar - 1 apr 1993)			
1	18:34026	*See* FNAL/C–93/157-E			
CONF-9303207–		(Symposium on alternative fuels and the environment; Ann Arbor, MI (United States); 28 Mar - 2 apr 1993)			
1	18:33751	*See* ANL/ER/CP–80321			
CONF-9303209–		(Department of Energy (DOE) defence programs pollution prevention and integrated technologies workshop; Santa Fe, NM (United States); 30 Mar 1993)			
1	18:32495	*See* UCRL-JC–113555			
CONF-9303213–		(3. research coordination meeting on food irradiation program for the Middle East and European countries; Cadarache (France); 8 Mar 1993)			
	18:33871	*See* AECS-A/FRSR–69			
CONF-9303216–		(Condensation and condenser design; St Augustine, FL (United States); 8-12 Mar 1993)			
1	18:32802	*See* ETDE-IT–93-202			
CONF-930331–		(6. Society for Industrial and Applied Mathematics (SIAM) conference on parallel processing for scientific computing; Norfolk, VA (United States); 21-24 Mar 1993)			
13	18:34648	*See* DOE/ER/25122–5			
14	18:34647	*See* DOE/ER/25122–4			
CONF-930363–		(28. conference on quantum chromodynamics and high energy hadronic interactions; Les Arcs (France); 13-27 Mar 1993)			
5	18:34043	*See* FNAL/C–93/166-E			
CONF-930364–		(Spring national meeting of the American Institute of Chemical Engineers; Houston, TX (United States); 28 Mar - 1 apr 1993)			
6	18:33752	*See* ANL/ES/CP–80079			
CONF-930367–		(Conference on spectroscopies in novel superconductors; Santa Fe, NM (United States); 17-19 Mar 1993)			
8	18:33216	*See* ANL/MSD/CP–80258			
CONF-930372–		(1993 international simulators conference on high performance computing; Arlington, VA (United States); 29 Mar - 1 apr 1993)			
12	18:33986	*See* SAND–93-0875C			
CONF-930405–		(Spring meeting of the Materials Research Society; San Francisco, CA (United States); 12-16 Apr 1993)			
31	18:33244	*See* ANL/MSD/CP–80248			
32	18:34453	*See* ANL/MSD/CP–79602			
33	18:33280	*See* SAND–93-0541C			
33	18:33451	*See* UCRL-JC–113814			
34	18:33231	*See* LA-UR–93-2693			
35	18:33277	*See* PNL-SA–22730			
CONF-930406–		(International high-level radioactive waste management conference; Las Vegas, NV (United States); 25-29 Apr 1993)			
52	18:32513	*See* WHC-SA–1807			
CONF-9304112–		(10. topical conference on radio frequency power in plasmas; Boston, MA (United States); 1-3 Apr 1993)			
20	18:34513	*See* PPPL–2925			
22	18:34524	*See* UCRL-JC–113265			
23	18:34523	*See* UCRL-JC–113264			

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CONF-930412–		(International symposium on the application of isotope techniques in studying past and current environmental changes in the hydrosphere and atmosphere; Vienna (Austria); 19-23 Apr 1993)			
1	18:33810	*See* IAEA-SM–329/21/0			
CONF-930413–		(18. international technical conference on coal utilization, slurry technologies and fuel systems; Clearwater, FL (United States); 26-29 Apr 1993)			
2	18:32211	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017257	MF-104
3	18:32184	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017121	MF-102
CONF-9304144–		(2. international conference on laser ablation: mechanisms and applications; Knoxville, TN (United States); 19-22 Apr 1993)			
10	18:34521	*See* UCRL-JC–113165			
11	18:33248	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018726	MF-404
CONF-9304166–		(Dislocations '93; Assois (France); 1-9 Apr 1993)			
1	18:33183	*See* LA-UR–93-2339			
CONF-9304181–		(IAEA's coordinated research on activation cross sections for the generation of long-lived and radionuclides of importance in fusion reactor technology; San Diego, CA (United States); 29-30 Apr 1993)			
1	18:34237	*See* ANL/EP/CP–79781			
CONF-9304183–		(4. tunnel detection symposium; Golden, CO (United States); 26-29 Apr 1993)			
1	18:34459	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018455	MF-703
CONF-9304184–		(Journees relativistes conference; Brussels (Belgium); 5-7 Apr 1993)			
1	18:34000	*See* LBL–34240			
CONF-9304185–		(DOE workshop on computational approaches in molecular radiation biology: Monte Carlo methods; Irvine, CA (United States); 26-29 Apr 1993)			
1	18:34413	*See* ANL/ER/CP–79720			
2	18:33953	*See* PNL-SA–21741			
CONF-9304189–		(1993 joint Army, Navy, NASA, Air Force (JANNAF) nondestructive evaluation subcommittee meeting; Livermore, CA (United States); 26-28 Apr 1993)			
3	18:33429	*See* UCRL-JC–113742			
CONF-930419–		(International conference on metallurgical coatings and thin films; San Diego, CA (United States); 19-23 Apr 1993)			
4	18:33145	*See* CEA-CONF–11310			
CONF-9304194–		(Tooldiag '93 International conference on fault diagnosis; Toulouse (France); 5-7 Apr 1993)			
1	18:33125	*See* ETDE-IT–93-197			
CONF-9304196–		(Austrian-Italian-Hungarian radiation protection symposium; Obergurgl (Austria); 28-30 Apr 1993)			
1	18:33655	*See* ETDE-IT–93-196			
CONF-930438–		(95. annual meeting of the American Ceramic Society; Cincinnati, OH (United States); 18-22 Apr 1993)			
28	18:33278	*See* PNL-SA–22777			
CONF-930445–		(Society of Photo-Optical Instrumentation Engineers (SPIE) OE/aerospace science and sensing meeting; Orlando, FL (United States); 11-16 Apr 1993)			
19	18:33428	*See* UCRL-JC–111856			
20	18:34472	*See* UCRL-JC–111857			
21	18:33996	*See* UCRL-JC–112216			
CONF-930449–		(International workshop on physics and instrumentation at future linear colliders; Kona, HI (United States); 26-30 Apr 1993)			
1	18:34035	*See* ANL-HEP-CP–93-24			

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CONF-930454–		(International seminar on molecular mechanisms in radiation mutagenesis and carcinogenesis; Doorwerth (Netherlands); 19-22 Apr 1993)			
3	18:33910	*See* ANL/CBM/CP–80231			
CONF-930461–		(12. IEEE symposium on mass storage systems; Monterey, CA (United States); 25 Apr 1993)			
5	18:34707	*See* UCRL-JC–112556			
CONF-930495–		(DOE/NARUC national conference on natural gas use: state regulation and market dynamics in the post-636/Energy Policy Act, Era; New Orleans, LA (United States); 26-28 Apr 1993)			
	18:32320	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019185	MF-900
CONF-930511–		(International particle accelerator conference; Washington, DC (United States); 17-20 May 1993)			
122	18:33557	*See* BNL–48231			
224	18:33518	*See* UCRL-JC–113638			
240	18:33575	*See* DOE/ER/40150–211			
243	18:34052	*See* DOE/ER/40150–223			
245	18:33475	*See* FNAL/C–93/111			
246	18:33504	*See* FNAL/C–93/120			
261	18:34488	*See* DOE/ER/40150–214			
268	18:33576	*See* DOE/ER/40150–212			
279	18:33526	*See* ANL/ASD/CP–78301			
280	18:33554	*See* ANL/PHY/CP–78215			
281	18:33553	*See* ANL/PHY/CP–78214			
285	18:33525	*See* ANL/ASD/CP–78297			
286	18:33527	*See* ANL/ASD/CP–78302			
287	18:33544	*See* ANL/ASD/VU–78283			
289	18:33559	*See* BNL–49169			
291	18:33521	*See* ANL/ASD/CP–78289			
292	18:33531	*See* ANL/ASD/CP–78340			
293	18:33558	*See* BNL–49141			
294	18:33579	*See* DOE/ER/40150–224			
295	18:33495	*See* ANL/PHY/CP–78090			
296	18:33524	*See* ANL/ASD/CP–78294			
297	18:33543	*See* ANL/ASD/CP–79833			
298	18:33635	*See* ANL/ASD/VU–78335			
299	18:33560	*See* BNL–49173			
300	18:33561	*See* BNL–49175			
301	18:33638	*See* BNL–49167			
302	18:33637	*See* BNL–49166			
303	18:33464	*See* BNL–48259			
305	18:33538	*See* ANL/ASD/CP–78368			
306	18:33634	*See* ANL/ASD/CP–78366			
308	18:33586	*See* FNAL/C–93/132			
309	18:33476	*See* FNAL/C–93/156			
309	18:33539	*See* ANL/ASD/CP–78533			
310	18:33492	*See* ANL/ASD/CP–78334			
310	18:33505	*See* FNAL/C–93/173			
311	18:33534	*See* ANL/ASD/CP–78345			
311	18:33639	*See* FNAL/C–93/125			
312	18:33529	*See* ANL/ASD/CP–78326			
312	18:33535	*See* ANL/ASD/CP–78346			
313	18:33522	*See* ANL/ASD/CP–78292			
314	18:33490	*See* ANL/ASD/CP–78300			
314	18:33523	*See* ANL/ASD/CP–78293			
315	18:33488	*See* UCRL-JC–112076			
315	18:33532	*See* ANL/ASD/CP–78341			
316	18:33499	*See* DOE/ER/40150–227			
316	18:33530	*See* ANL/ASD/CP–78330			
317	18:33491	*See* ANL/ASD/CP–78331			
317	18:33580	*See* DOE/ER/40150–226			
318	18:33625	*See* SSCL-Preprint–419			
319	18:33465	*See* BNL–49213			
320	18:33537	*See* ANL/ASD/CP–78367			
321	18:33462	*See* ANL-HEP-CP–93-42			
322	18:33508	*See* LBL–33286			
323	18:33507	*See* LBL–33285			
324	18:33610	*See* LBL–33291			

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325	18:33606	*See* LBL–33224			
326	18:33547	*See* ANL-HEP-CP–93-40			
326	18:33548	*See* ANL-HEP-CP–93-41			
328	18:33528	*See* ANL/ASD/CP–78325			
329	18:33503	*See* DOE/ER/40747–7			
330	18:33461	*See* ANL/EP/CP–78374			
331	18:33605	*See* LBL–33221			
332	18:33481	*See* LBL–33223			
333	18:33546	*See* ANL/EP/CP–78373			
334	18:33643	*See* LBL–33220			
335	18:34614	*See* LBL–33289			
336	18:34621	*See* UCRL-JC–112344			
337	18:34622	*See* UCRL-JC–112377			
338	18:33612	*See* LBL–33294			
339	18:33644	*See* LBL–33265			
340	18:34612	*See* LBL–33284			
341	18:34613	*See* LBL–33287			
342	18:33611	*See* LBL–33292			
343	18:33604	*See* LBL–33197			
344	18:33603	*See* LBL–33190			
345	18:33494	*See* ANL/EP/CP–78375			
346	18:33545	*See* ANL/EP/CP–78284			
347	18:33463	*See* ANL-HEP-CP–93-43			
348	18:33608	*See* LBL–33283			
349	18:33533	*See* ANL/ASD/CP–78342			
350	18:33514	*See* SSCL-Preprint–474			
351	18:33509	*See* LBL–34072			
352	18:33607	*See* LBL–33254			
353	18:33609	*See* LBL–33290			
354	18:33482	*See* LBL–33240			
355	18:33613	*See* LBL–33315			
357	18:33519	*See* ANL/ASD/CP–78165			
358	18:33536	*See* ANL/ASD/CP–78348			
359	18:33552	*See* ANL/PHY/CP–78195			
360	18:33489	*See* UCRL-JC–114214			
361	18:33520	*See* ANL/ASD/CP–78166			
367	18:33493	*See* ANL/EP/CP–78372			
368	18:33549	*See* ANL-HEP-CP–93-44			
391	18:33513	*See* SSCL-Preprint–403			
67	18:33624	*See* SSCL-Preprint–387			
CONF-9305124–		(Chemical sensor symposium; Honolulu, HI (United States); 16-21 May 1993)			
3	18:33316	*See* UCRL-JC–112182			
CONF-9305135–		(7. annual conference on fossil energy materials; Oak Ridge, TN (United States); 11-13 May 1993)			
7	18:33150	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017852	MF-114
8	18:33151	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017865	MF-114
9	18:33152	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017862	MF-114
CONF-9305136–		(International symposium on heavy ion fusion; Frascati (Italy); 25-28 May 1993)			
10	18:34615	*See* LBL–33804			
CONF-9305148–		(International conference on meson-nucleus interactions; Crakow (Poland); 14-19 May 1993)			
1	18:34048	*See* LA-UR–93-2652			
CONF-9305159–		(Optical Society of America (OSA) topical meeting on soft x-ray projection lithography; Monterey, CA (United States); 10-12 May 1993)			
3	18:32628	*See* UCRL-JC–114922			
CONF-9305166–		(American Filtration Society seminar and expo annual meeting; Chicago, IL (United States); 3-6 May 1993)			
3	18:33403	*See* UCRL-JC–113854			
CONF-9305175–		(Individual monitoring of ionizing radiation: the impact of recent ICRP and ICRU publications; Villigen (Germany); 5-7 May 1993)			
1	18:33922	*See* ETDE-IT–93-210			
2	18:33923	*See* ETDE-IT–93-211			

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CONF-9305177–		(12. International collaboration of advanced neutron sources meeting (ICANS); Abingdon (United Kingdom); 24-28 May 1993)			
8	18:32620	*See* ANL/IPNS/CP–79155			
8	18:33288	*See* ANL/MSD/CP–79154			
9	18:33542	*See* ANL/ASD/CP–79828			
10	18:33453	*See* ANL/ASD/CP–79827			
10	18:33551	*See* ANL/IPNS/CP–78912			
11	18:33550	*See* ANL/IPNS/CP–78911			
11	18:33646	*See* ANL/IPNS/CP–79156			
CONF-9305186–		(7. international conference on solid state sensors and actuators; No City Given (Japan); 13-15 May 1993)			
1	18:33441	*See* SAND–93-1006C			
CONF-9305189–		(1993 joint Army, Navy, NASA, Air Force (JANNAF) Propulsion Systems Hazards Subcommittee meeting; Ft. Lewis, WA (United States); 10-14 May 1993)			
5	18:33727	*See* UCRL-JC–112314			
CONF-9305203–		(International school seminar on heavy ion physics; Dubna (Russian Federation); 10-15 May 1993)			
2	18:33483	*See* LBL–34239			
CONF-9305235–		(International workshop/time reversal invariance and parity violation in neutron physics; Dubna (Russian Federation); 4-7 May 1993)			
3	18:34056	*See* LA-UR–93-2644			
CONF-9305241–		(International particle accelerator conference; 6. international workshop on perspectives in intermediate energy nuclear physics; Washington, DC (United States); Trieste (Italy); 17-20 May 1993; 4-7 may 1993)			
1	18:34052	*See* DOE/ER/40150–223			
2	18:34036	*See* ANL/PHY/CP–80056			
CONF-9305242–		(International conference on intelligent and cooperative information systems; Rotterdam (Netherlands); 11-14 May 1993)			
1	18:34697	*See* ANL/MCS/CP–80152			
CONF-9305245–		(Department of Defense/Industry Advanced Coatings Removal conference; Phoenix, AZ (United States); 25-27 May 1993)			
1	18:33104	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017763	
CONF-9305250–		(14. biennal workshop on color photography and videography in resource monitoring; Logan, UT (United States); 25-29 May 1993)			
1	18:32679	*See* ANL/EAIS/CP–80295			
CONF-9305254–		(Ultrafast reaction dynamics and solvent effects; Asnieres Sur Oise (France); 11-15 May 1993)			
1	18:33318	*See* ANL/CHM/CP–79706			
CONF-930534–		(3. international conference on radioactive nuclear beams; East Lansing, MI (United States); 24-27 May 1993)			
2	18:34064	*See* BNL–49079			
5	18:34410	*See* LBL–34277			
CONF-930537–		(5. annual international industrial symposium on the Super Collider and exhibition; San Francisco, CA (United States); 6-8 May 1993)			
102	18:33629	*See* SSCL-Preprint–487			
104	18:33622	*See* SSCL-Preprint–335			
37	18:33616	*See* SSCL-Preprint–247			
80	18:33620	*See* SSCL-Preprint–316			
86	18:33621	*See* SSCL-Preprint–317			
87	18:33487	*See* SSCL-Preprint–310			
89	18:33618	*See* SSCL-Preprint–303			
90	18:33623	*See* SSCL-Preprint–336			
91	18:33458	*See* SSCL-Preprint–331			
92	18:33687	*See* UCRL-JC–113960			
93	18:33619	*See* SSCL-Preprint–307			
94	18:33688	*See* UCRL-JC–114014			
95	18:33617	*See* SSCL-Preprint–283			
96	18:33689	*See* UCRL-JC–114015			

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CONF-930538–		(4. conduct of operations workshop: the key to continued success; Tampa, FL (United States); 4-6 May 1993)			
4	18:34637	*See* PNL-SA–22371			
CONF-930544–		(Conference on polarized ion sources and polarized gas targets; Madison, WI (United States); 23-27 May 1993)			
3	18:33636	*See* ANL/PHY/CP–80101			
CONF-930571–		(183. Electrochemical Society meeting; Honolulu, HI (United States); 16-21 May 1993)			
24	18:33337	*See* LA-UR–93-2196			
CONF-930572–		(12. annual international symposium on thermal treatment technologies - incineration conference; Knoxville, TN (United States); 3-7 May 1993)			
8	18:33750	*See* ANL/CMT-ACL/CP–77718			
10	18:32360	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017861	MF-902
CONF-930586–		(Quantum electronics and laser science conference; Baltimore, MD (United States); 2-7 May 1993)			
6	18:33449	*See* UCRL-JC–113579			
CONF-930589–		(4. international conference on contaminated soil; Berlin (Germany); 3-7 May 1993)			
4	18:33829	*See* UCRL-JC–113731			
CONF-930601–		(American Nuclear Society (ANS) annual meeting; San Diego, CA (United States); 20-24 Jun 1993)			
22	18:32535	*See* WINCO–11902			
27	18:32823	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017851	MF-411
CONF-930607–		(1. international workshop on indoor radon remedial action; Rimini (Italy); 27 Jun - 2 jul 1993)			
1	18:33911	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017859	MF-607
CONF-9306100–		(Zeolite 93: 4th international conference on the occurrence, properties, and utilization of natural zeolites; Boise, ID (United States); 20-28 Jun 1993)			
4	18:32427	*See* LA-UR–93-2761			
CONF-9306143–		(Energy Facility Contractors Group safety analysis meeting; Denver, CO (United States); 16-18 Jun 1993)			
15	18:32572	*See* RFP–4717			
CONF-9306151–		(7. international symposium on methodologies for intelligent systems; Trondheim (Norway); 15-18 Jun 1993)			
1	18:34641	*See* ANL/MCS/CP–80151			
CONF-930616–		(9. IEEE pulsed power conference; Albuquerque, NM (United States); 21-23 Jun 1993)			
15	18:34511	*See* LA-UR–93-2769			
16	18:33601	*See* LA-UR–93-2450			
17	18:33602	*See* LA-UR–93-2675			
18	18:33438	*See* LA-UR–93-2623			
19	18:33517	*See* UCRL-JC–112511			
20	18:32965	*See* LA-UR–93-2401			
21	18:33015	*See* SAND–93-0183C			
22	18:33444	*See* SAND–93-1474C			
CONF-9306176–		(Workshop on physics at current accelerators and the supercollider; Argonne, IL (United States); 2-5 Jun 1993)			
4	18:34050	*See* LBL–34372			
5	18:34058	*See* LBL–34313			
CONF-9306180–		(9. annual joint Government-Industry symposium on security technology; Virginia Beach, VA (United States); 21-24 Jun 1993)			
3	18:32607	*See* SAND–93-0470C			
4	18:32609	*See* SAND–93-1510C			
5	18:32608	*See* SAND–93-0771C			
6	18:32606	*See* SAND–93-0445C			

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CONF-9306189--		(NE '93: 4th annual scientific and technical conference of the Nuclear Society: nuclear energy and human safety; Nizhni Novgorod (Russian Federation); 28 Jun - 2 jul 1993)			
3	18:32941	*See* PNL-SA-21788			
4	18:32896	*See* PNL-SA-21780			
CONF-9306203--		(2. Prague colloquium on quantum groups; Prague (Czech Republic); 24-26 Jun 1993)			
1	18:33987	*See* ANL-HEP-CP-93-39			
CONF-9306204--		(Project energy '93; Kansas City, MO (United States); 21-23 Jun 1993)			
1	18:32154	*See* BNL-49193			
CONF-9306205--		(1993 Institute of Electrical and Electronic Engineers (IEEE) frequency control symposium; Salt Lake City, UT (United States); 2-4 Jun 1993)			
1	18:33440	*See* SAND-93-0145C			
CONF-9306207--		(1. international workshop on indoor radon remedial action; Rimini (Italy); 27 Jun - 2 jul 1993)			
1	18:33756	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017855	MF-603
CONF-930621--		(American Society of Mechanical Engineers (ASME) fluids engineering conference; Washington, DC (United States); 20-24 Jun 1993)			
4	18:33419	*See* PNL-SA-21173			
CONF-9306211--		(Defense Nuclear Agency's international conference on controlling arms; Richmond, VA (United States); 7-10 Jun 1993)			
1	18:33140	*See* UCRL-JC-113871			
CONF-9306213--		(Latin American Energy Conference; La Jolla, CA (United States); 6-8 Jun 1993)			
1	18:32982	*See* PNL-SA-22611			
CONF-9306214--		(Carbon sinks workshop for the interagency national action plan development process; Washington, DC (United States); 10-11 Jun 1993)			
1	18:33781	*See* PNL-SA-22658			
CONF-9306216--		(3. Twente workshop on graphs and combinatorial optimization; Enschede (Netherlands); 2-4 Jun 1993)			
1	18:34683	*See* SAND-93-1393C			
CONF-9306228--		(6. international conference on muon spin rotation/relaxation/resonance; Maui, HI (United States); 7-11 Jun 1993)			
1	18:34467	*See* LA-UR-93-2556			
CONF-9306229--		(International particle accelerator conference; 1993 meeting of Korea Accelerator and Plasma Research Association; Washington, DC (United States); Daejon (Korea, Republic of); 17-20 May 1993; 30 jun 1993)			
1	18:33528	*See* ANL/ASD/CP-78325			
CONF-930639--		(International conference on enrichment; Washington, DC (United States); 13-15 Jun 1993)			
1	18:32334	*See* UCRL-JC-114211			
CONF-930640--		(8. IEEE conference on real-time computer applications in nuclear, particle and plasma physics; Vancouver (Canada); 8-11 Jun 1993)			
2	18:33615	*See* PNL-SA-21926			
3	18:33628	*See* SSCL-Preprint-478			
4	18:33684	*See* PNL-SA-22024			
5	18:33562	*See* BNL-49264			
CONF-930647--		(86. annual meeting and exhibition of the Air and Waste Management Association (AWMA); Denver, CO (United States); 13-18 Jun 1993)			
6	18:33826	*See* PNL-SA-21625			
8	18:32570	*See* PNL-SA-21495			
CONF-930652--		(20. IEEE international conference on plasma sciences; Vancouver (Canada); 7-9 Jun 1993)			
1	18:33782	*See* PPL-2923			
CONF-930663--		(American control conference (ACC); San Francisco, CA (United States); 2-4 Jun 1993)			
2	18:33387	*See* PNL-SA-22041			

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CONF-930672–		(3. international joint ISA POWID/EPRI controls and instrumentation conference; Phoenix, AZ (United States); 7-9 Jun 1993)			
1	18:33290	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017769	
CONF-930675–		(1993 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) summer meeting; Denver, CO (United States); 26-30 Jun 1993)			
6	18:33408	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018603	MF-350
CONF-930676–		(14. international conference of the International Association for the Advancement of High Pressure Science and Technology; Colorado Springs, CO (United States); 27 Jun - 2 jul 1993)			
3	18:34514	*See* SAND–93-0425C			
6	18:33199	*See* SAND–93-1455C			
8	18:33195	*See* SAND–93-0390C			
9	18:34457	*See* SAND–93-1395C			
10	18:33196	*See* SAND–93-0427C			
11	18:33396	*See* SAND–93-0559C			
12	18:33427	*See* SAND–93-0418C			
13	18:33702	*See* SAND–93-0882C			
14	18:33424	*See* LA-UR–93-2468			
16	18:33274	*See* LA-UR–93-2291			
17	18:33182	*See* LA-UR–93-2290			
18	18:33716	*See* LA-UR–93-2347			
20	18:33715	*See* LA-UR–93-2345			
24	18:33717	*See* LA-UR–93-2348			
25	18:33747	*See* SAND–93-0402C			
26	18:34002	*See* SAND–93-0457C			
27	18:33239	*See* SAND–93-0388C			
28	18:33710	*See* SAND–93-0389C			
29	18:33186	*See* LA-UR–93-2799			
30	18:34456	*See* LA-UR–93-2692			
31	18:33275	*See* LA-UR–93-2690			
32	18:33205	*See* UCRL-JC–113151			
33	18:33181	*See* LA-UR–93-2214			
35	18:33281	*See* SAND–93-0743C			
46	18:34446	*See* UCRL-JC–114575			
CONF-930702–		(Pressure vessels and piping conference; Denver, CO (United States); 25-29 Jul 1993)			
47	18:33402	*See* UCRL-JC–113750			
48	18:33371	*See* EGG-M–93100			
49	18:32946	*See* WSRC-MS–93-025			
CONF-930703–		(International cryogenic engineering conference and international cryogenic materials conference; Albuquerque, NM (United States); 12-16 Jul 1993)			
7	18:33215	*See* ANL/MCT/CP–78646			
8	18:33212	*See* ANL/ET/CP–78557			
10	18:33241	*See* ANL/ET/CP–78558			
11	18:33626	*See* SSCL-Preprint–449			
12	18:34623	*See* UCRL-JC–112762			
13	18:33994	*See* LA-UR–93-2515			
14	18:32565	*See* LA-UR–93-2516			
15	18:33417	*See* LA-UR–93-2656			
16	18:33627	*See* SSCL-Preprint–475			
17	18:33332	*See* LA-UR–93-2372			
18	18:33213	*See* ANL/ET/CP–78580			
19	18:34487	*See* ANL/ET/CP–80302			
20	18:33563	*See* BNL–49307			
CONF-9307101–		(9. annual waste testing and quality assurance symposium; Arlington, VA (United States); 12-16 Jul 1993)			
2	18:33795	*See* ANL/ER/CP–79013			
3	18:32468	*See* RFP–4730			
CONF-9307103–		(11. international system safety conference; Cincinnati, OH (United States); 28 Jul - 2 aug 1993)			
2	18:32557	*See* EGG-M–93238			
4	18:33793	*See* WSRC-MS–93-326			

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CONF-9307107–		(DOE workshop: sedimentary systems, aqueous and organic geochemistry; Berkeley, CA (United States); 15-16 Jul 1993)			
	18:33983	*See* LBL-PUB–728			
CONF-9307110–		(Basic energy sciences geosciences conference on rock-water interaction; Berkeley, CA (United States); 15-16 Jul 1993)			
1	18:33336	*See* SAND–93-1554C			
CONF-9307111–		(2. international symposium on high-performance distributed computing; Spokane, WA (United States); 20-23 Jul 1993)			
	18:34642	*See* ANL/MCS/CP–80307			
2	18:33789	*See* UCRL-JC–113039			
CONF-9307112–		(International workshop on optoelectronic packaging science; Santa Barbara, CA (United States); 28 Jul 1993)			
1-Vugraphs	18:33447	*See* SAND–93-1773C			
CONF-9307113–		(16. international conference on x-ray and inner shell processes; Debrecen (Hungary); 12-16 Jul 1993)			
1	18:34429	*See* UCRL-JC–113914			
CONF-9307114–		(14. international workshop on weak interactions and neutrinos; Seoul (Korea, Republic of); 19-24 Jul 1993)			
1	18:34057	*See* LA-UR–93-2659			
CONF-9307115–		(Electric Power Research Institute (EPRI) utility-industry workshop on pressurized-water reactor (PWR) fuel rod corrosion; Washington, DC (United States); 28-30 Jul 1993)			
1	18:33208	*See* WAPD-T–3010			
CONF-9307116–		(Polarization and correlation in electronic and atomic collisions; Bielefeld (Germany); 29-31 Jul 1993)			
1	18:34442	*See* LA-UR–93-2486			
CONF-930712–		(ICACS: 15. international conference on atomic collision in solids; London (Canada); 26-30 Jul 1993)			
1	18:33144	*See* ANL/MSD/CP–79243			
CONF-9307125–		(^{3}He and fusion power symposium; Madison, WI (United States); 18-22 Jul 1993)			
1	18:34611	*See* LA-UR–93-2700			
CONF-930713–		(10. detonation symposium; Boston, MA (United States); 12-16 Jul 1993)			
13	18:33770	*See* LA-UR–93-1815			
20	18:33719	*See* LA-UR–93-2548			
21	18:33718	*See* LA-UR–93-2547			
22	18:33720	*See* LA-UR–93-2550			
CONF-930720–		(20. European conference on controlled fusion and plasma physics; Lisbon (Portugal); 26-30 Jul 1993)			
18	18:34624	*See* UCRL-JC–113033			
19	18:34529	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018458	MF-420
CONF-930722–		(Annual meeting of the Society of Photo-Optical Instrumentation Engineers (SPIE); San Diego, CA (United States); 11-16 Jul 1993)			
9	18:34527	*See* ANL/EP/CP–78902			
10	18:33555	*See* ANL/XFD/CP–78532			
13	18:33541	*See* ANL/ASD/CP–78751			
15	18:33452	*See* UCRL-JC–114422			
16	18:33540	*See* ANL/ASD/CP–78534			
17	18:33693	*See* LA-UR–93-2544			
19	18:33480	*See* LA-UR–93-2627			
20	18:33497	*See* BNL–49276			
CONF-930726–		(Windpower '93; San Francisco, CA (United States); 12-16 Jul 1993)			
4	18:32735	*See* PNL-SA–22090			
5	18:32747	*See* SAND–93-0391C			
CONF-930741–		(World congress on neural networks; Portland, OR (United States); 11-15 Jul 1993)			
4	18:33439	*See* PNL-SA–21852			
5	18:33386	*See* PNL-SA–21767			

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CONF-930746–		(Annual meeting of the Health Physics Society; Atlanta, GA (United States); 11-15 Jul 1993)			
1	18:33959	*See* WHC-SA–1826			
CONF-930749–		(34. annual meeting of the Institute of Nuclear Materials Management; Scottsdale, AZ (United States); 18-21 Jul 1993)			
7	18:32615	*See* WSRC-MS–93-073			
9	18:33137	*See* SAND–93-1633C			
11	18:32349	*See* SAND–93-0135C			
12	18:34706	*See* SAND–93-1721C			
13	18:32611	*See* SAND–93-1678C			
16	18:34705	*See* SAND–93-1701C			
22	18:32613	*See* SAND–93-1699C			
23	18:32612	*See* SAND–93-1693C			
24	18:32586	*See* BNL–48556			
25	18:32592	*See* LA-UR–93-2581			
27	18:32597	*See* LA-UR–93-2668			
28	18:32595	*See* LA-UR–93-2639			
30	18:33128	*See* BNL–48581			
31	18:33139	*See* SAND–93-1714C			
32	18:32590	*See* LA-UR–93-2568			
33	18:34681	*See* SAND–93-1355C			
34	18:32425	*See* LA-UR–93-2624			
35	18:32596	*See* LA-UR–93-2667			
36	18:32593	*See* LA-UR–93-2603			
37	18:32422	*See* LA-UR–93-2584			
38	18:33376	*See* LA-UR–93-2503			
39	18:34663	*See* LA-UR–93-2585			
40	18:32598	*See* LA-UR–93-2669			
41	18:33135	*See* LA-UR–93-2586			
42	18:32423	*See* LA-UR–93-2605			
44	18:32424	*See* LA-UR–93-2608			
45	18:32594	*See* LA-UR–93-2610			
47	18:32589	*See* LA-UR–93-2538			
48	18:32781	*See* LA-UR–93-2537			
50	18:32610	*See* SAND–93-1669C			
51	18:33138	*See* SAND–93-1667C			
52	18:33743	*See* BNL–49247			
53	18:33692	*See* BNL–48563			
54	18:32614	*See* UCRL-JC–114597			
55	18:32585	*See* BNL–48555			
56	18:32584	*See* BNL–48554			
CONF-930755–		(6. analytical electron microcopy (AEM) workshop; Los Angeles, CA (United States); 11-16 Jul 1993)			
3	18:33699	OSTI; NTIS; GPO Dep.	E 1.99:	DE93015334	MF-406
CONF-930785–		(8. international conference on numerical methods in laminar and trubulent flow; Swansea (United Kingdom); 18-23 Jul 1993)			
2	18:34009	*See* UCRL-JC–112660			
CONF-930787–		(9. annual coal preparation, utilization, and environmental control contractors' conference; Pittsburgh, PA (United States); 19-22 Jul 1993)			
4	18:32748	*See* ANL/EP/CP–79808			
CONF-930796–		(1993 Chinese American Academic and Professional convention; Chicago, IL (United States); 2-5 Jul 1993)			
3	18:33143	*See* ANL/ET/CP–78882			
CONF-930801–		(Conference of the International Union of Pure and Applied Physics on low temperature physics (LT 20); Eugene, OR (United States); 1-11 Aug 1993)			
6	18:33232	*See* LBL–34030			
CONF-930802–		(206. American Chemical Society national meeting; Chicago, IL (United States); 22-27 Aug 1993)			
4	18:32185	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017765	MF-401
8	18:33317	*See* ANL/CHM/CP–79281			
12	18:33960	*See* ANL/ESH/CP–80561			

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CONF-930803–		(12. biennial conference for the International Association for Structural Mechanics in Reactor Technology (SMIRT 12); Stuttgart (Germany); 16-26 Aug 1993)			
18	18:32905	*See* ANL/RE/CP–78655			
19	18:32906	*See* ANL/RE/CP–78807			
24	18:33348	*See* ANL/RE/CP–78822			
CONF-930804–		(28. intersociety energy conversion engineering conference; Atlanta, GA (United States); 8-13 Aug 1993)			
10	18:32633	*See* LA-UR–93-2355			
14	18:32697	*See* SAND–92-2347C			
CONF-930810–		(Topical meeting on environmental transport and dosimetry; Charleston, SC (United States); 31 Aug - 3 sep 1993)			
4	18:33790	*See* UCRL-JC–114013			
5	18:33791	*See* UCRL-JC–114098			
CONF-9308105–		(1. biomass conference of the Americas; Burlington, VT (United States); 30 Aug - 2 sep 1993)			
1	18:32674	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017759	MF-246
CONF-9308110–		(17. annual symposium of the Nuclear Information and Records Management Association; Augusta, GA (United States); 29 Aug - 2 sep 1993)			
1	18:34633	*See* EGG-M–93052			
CONF-9308122–		(3. international conference on advanced materials; Tokyo (Japan); 31 Aug - 4 sep 1993)			
1	18:34486	*See* ANL/ET/CP–78928			
2	18:33214	*See* ANL/ET/CP–78942			
CONF-9308126–		(Surface Mount Technical Association international conference; San Jose, CA (United States); 31 Aug - 2 sep 1993)			
2	18:33443	*See* SAND–93-1414C			
CONF-9308129–		(22. annual international conference on parallel processing; University Park, PA (United States); 16-20 Aug 1993)			
1	18:34693	*See* UCRL-JC–113858			
CONF-9308133–		(Army symposium on solid mechanics; Plymouth, MA (United States); 17-19 Aug 1993)			
1	18:33709	*See* SAND–93-0332C			
2	18:32519	*See* WSRC-MS–92-267			
CONF-9308134–		(National fire control symposium; Boulder, CO (United States); 3-5 Aug 1993)			
1-Vugraphs	18:33711	*See* SAND–93-1674C			
CONF-9308136–		(5. international conference on ion sources; Peking (China); 31 Aug - 4 sep 1993)			
1	18:33633	*See* UCRL-JC–114625			
CONF-9308137–		(1993 summer national American Institute of Chemical Engineers (AIChE) conference; Seattle, WA (United States); 15-18 Aug 1993)			
3	18:32757	*See* ANL/ES/CP–80346			
4	18:32421	*See* LA-UR–93-2440			
CONF-9308138–		(11. international invitational symposium on the unification of analytical, computational, and experimental solution methodologies; Danvers, MA (United States); 18-20 Aug 1993)			
1	18:33377	*See* LA-UR–93-2611			
CONF-9308139–		(SMIRT-12: Structural Mechanics in Reactor Technology conference on upgrading of existing 440 and 1000 MW VVER type pressurized water reactors for severe external loading conditions; Vienna (Austria); 23-25 Aug 1993)			
1	18:32907	*See* ANL/RE/CP–80363			
CONF-9308140–		(8. international conference on rapidly quenched and metastable materials; Sendai (Japan); 22-27 Aug 1993)			
2	18:33184	*See* LA-UR–93-2499			

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CONF-9308143–		(1993 Society of Automotive Engineers (SAE) future transportation technology conference; San Antonio, TX (United States); 9-12 Aug 1993)			
4	18:33124	*See* ANL/ES/CP–80046			
CONF-9308148–		(37. International Union of Pure and Applied Chemistry (IUPAC) meeting; Lisbon (Portugal); 5-12 Aug 1993)			
3	18:34153	*See* BNL–49336			
CONF-930825–		(6. international symposium on environmental degradation of materials in nuclear power systems: water reactors; San Diego, CA (United States); 3-5 Aug 1993)			
3	18:33153	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017864	MF-404
4	18:33207	*See* WAPD-T–2989			
CONF-930840–		(2. international symposium on magnetic suspension technology; Seattle, WA (United States); 11-13 Aug 1993)			
1	18:33445	*See* SAND–93-1597C			
CONF-930842–		(6. international conference on energy program evaluation: uses, methods and results; Chicago, IL (United States); 23-27 Aug 1993)			
1	18:33078	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017860	MF-350
2	18:33079	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017866	MF-350
3	18:33080	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017756	MF-350
CONF-930854–		(36. Midwest symposium on circuits and systems; Detroit, MI (United States); 16-18 Aug 1993)			
1	18:33242	*See* ANL/ET/CP–78721			
CONF-930865–		(International conference on strongly correlated electron systems; La Jolla, CA (United States); 16-19 Aug 1993)			
1	18:34485	*See* ANL/MSD/CP–80489			
CONF-930873–		(2. international mixed waste symposium; Baltimore, MD (United States); 17-20 Aug 1993)			
21	18:32492	*See* UCRL-JC–112666			
22	18:32355	*See* ANL/EWM/CP–80486			
23	18:32494	*See* UCRL-JC–112670			
24	18:32493	*See* UCRL-JC–112669			
CONF-930895–		(International energy and environmental congress; Minneapolis, MN (United States); 4-5 Aug 1993)			
	18:33061	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040609	MF-222; MF-249
CONF-930904–		(7. international coal science conference; Banff (Canada); 12-17 Sep 1993)			
3	18:32182	*See* SAND–93-1333C			
4	18:32186	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017766	MF-401
5	18:32155	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017757	MF-401
CONF-930905–		(Actinides '93; Santa Fe, NM (United States); 19-24 Sep 1993)			
1	18:33185	*See* LA-UR–93-2739			
CONF-930906–		('93 international conference on nuclear waste management and environmental remediation; Prague (Czech Republic); 5-11 Sep 1993)			
11	18:32518	*See* WINCO–11926			
CONF-930907–		(ANS topical meeting on physics and methods in criticality safety; Nashville, TN (United States); 19-23 Sep 1993)			
7	18:32351	*See* UCRL-JC–113529			
8	18:33350	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017770	MF-500
9	18:33351	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018718	MF-940
CONF-9309103–		(7. symposium on containment of underground nuclear explosions; Kent, WA (United States); 15-16 Sep 1993)			
1	18:33739	*See* UCRL-JC–113334			
CONF-9309108–		(9. international conference on heavy metals in the environment; Toronto (Canada); 12-17 Sep 1993)			
1	18:32731	*See* BNL–48458			

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CONF-9309111–		(10. annual international Pittsburgh coal conference: coal - energy and the environment; Pittsburgh, PA (United States); 20-24 Sep 1993)			
1	18:32181	*See* SAND–93-0421C			
CONF-9309120–		(American Nuclear Society meeting; Nashville, TN (United States); 19-23 Sep 1993)			
4	18:32335	*See* Y/DD–608			
CONF-9309124–		(18. annual international conference on infrared and millimeter waves; Colchester (United Kingdom); 6-10 Sep 1993)			
1	18:34625	*See* UCRL-JC–114531			
CONF-930913–		(Global '93: future nuclear systems - emerging fuel cycles and waste disposal options; Seattle, WA (United States); 12-17 Sep 1993)			
11	18:32419	*See* LA-UR–93-2171			
13	18:32818	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017761	MF-521
14	18:32824	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017762	MF-521
15	18:34426	*See* LA-UR–93-2582			
16	18:32358	*See* BNL–49295			
17	18:32340	*See* EGG-M–93267			
18	18:32512	*See* WHC-SA–1753			
20	18:32588	*See* LA-UR–93-2218			
21	18:32900	*See* WHC-SA–1816			
23	18:32812	*See* WHC-SA–1815			
CONF-9309173–		(Capture gamma-ray symposium; Fribourg (Switzerland); 20-24 Sep 1993)			
3	18:34412	*See* UCRL-JC–113668			
CONF-9309176–		(2. international conference on computational physics; Beijing (China); 13-17 Sep 1993)			
1	18:34430	*See* UCRL-JC–114326			
2	18:33999	*See* LA-UR–93-2541			
CONF-9309195–		(Static memory interface conference; San Jose, CA (United States); 1 Sep 1993)			
1	18:33442	*See* SAND–93-1063C			
CONF-9309199–		(Society of Photo-Optical Instrumentation Engineer's (SPIE) international symposium on optical tools for manufacturing and advanced automation; Boston, MA (United States); 7-10 Sep 1993)			
1	18:32577	*See* SAND–93-1403C			
CONF-9309201–		(1993 Institute of Electriccal and Electronic Engineers (IEEE) international ASIC conference and exhibit; Rochester, NY (United States); 27 Sep 1993)			
1	18:33446	*See* SAND–93-1598C			
CONF-9309205–		(3. conference on the mechanical behavior of salt; Paliseau (France); 14-16 Sep 1993)			
2	18:32484	*See* SAND–93-1348C			
CONF-930928–		(6. international conference on fusion reactor materials; Stresa (Italy); 27 Sep - 1 oct 1993)			
1	18:34626	*See* WSRC-MS–93-091			
CONF-931009–		(Fall meeting of the Minerals, Metals and Materials Society: physical metallurgy and materials in conjunction with materials week and the Materials Applications and Services Exposition; Pittsburgh, PA (United States); 17-21 Oct 1993)			
1	18:33194	*See* RFP–4739			
CONF-9310100–		(Human Factors and Ergonomics Society meeting; Seattle, WA (United States); 11-15 Oct 1993)			
1	18:32573	*See* RFP–4720			
2	18:33388	*See* RFP–4719			
CONF-9310101–		(DOE radiation protection workshop; Asia and Pacific Basin Regional Congress on radiation protection; Las Vegas, NV (United States); Beijing (China); Mar 1993; 18-22 oct 1993)			
1	18:33956	*See* SAND–93-0761C			

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CONF-9310102–		(4. energy natural phenomena hazards mitigation conference; Atlanta, GA (United States); 19-22 Oct 1993)			
1	18:33834	*See* WSRC-MS–93-361			
2	18:33003	*See* RFP–4729			
4	18:32574	*See* RFP–4725			
CONF-9310103–		(4. USENIX UNIX security symposium; Santa Clara, CA (United States); 4-7 Oct 1993)			
1	18:34695	*See* UCRL-JC–113875			
CONF-9310104–		(24. Project Management Institute annual seminar; San Diego, CA (United States); 1-7 Oct 1993)			
1	18:34639	*See* SAND–93-1444C			
CONF-9310123–		(14. biennial Pan American Congress of Mechanical and Electrical Engineers; San Juan (Puerto Rico); 3-8 Oct 1993)			
1	18:33686	*See* UCRL-JC–113721			
CONF-9310131–		(29. annual international telemetering conference; Las Vegas, NV (United States); 25-28 Oct 1993)			
1	18:32745	*See* NREL/TP–442-5617			
CONF-9310132–		(1993 Institute of Electrical and Electronics Engineers (IEEE) international Carnahan conference on security technology; Ottawa (Canada); 13-17 Oct 1993)			
1	18:33103	*See* SAND–92-2801C			
CONF-9310133–		(Time dependence of radiation damage accumulation and its impact on material properties; Montreau (Switzerland); 14-21 Oct 1993)			
1	18:33193	*See* PNL-SA–21235			
CONF-9310142–		(Institute for Electrical and Electronics Engineers/American Institute of Aeronautics and Astronautics (IEEE/AIAA) digital avionics systems conference and technical display; Ft. Worth, TX (United States); 25-28 Oct 1993)			
1	18:33430	*See* UCRL-JC–114935			
CONF-931019–		(Annual model conference; Oak Ridge, TN (United States); 19-22 Oct 1993)			
1	18:32539	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000972	MF-630
CONF-931024–		(184. meeting of the Electrochemical Society; New Orleans, LA (United States); 10-15 Oct 1993)			
1	18:32973	*See* SAND–93-1083C			
2	18:32311	*See* SAND–93-1180C			
CONF-931042–		(Annual meeting of the Geothermal Resources Council; San Francisco, CA (United States); 10-13 Oct 1993)			
1	18:32721	*See* LA-UR–93-1424			
2	18:32722	*See* LA-UR–93-2073			
3	18:32727	*See* LA-UR–93-2151			
4	18:32729	*See* LA-UR–93-2183			
CONF-931055–		(6. international symposium of robotics research; Pittsburgh, PA (United States); 2 Oct 1993)			
1	18:33395	*See* SAND–93-0242C			
CONF-931066–		(American Association of Adult Continuing Education (AAACE) conference; Dallas, TX (United States); Oct 1993)			
1	18:34635	*See* LA-UR–93-913			
CONF-931078–		(Mechanism and mechanics of composite fracture meeting; Pittsburgh, PA (United States); 17-21 Oct 1993)			
1	18:33271	*See* IS-M–747			
CONF-931079–		(20. water reactor safety information meeting; Bethesda, MD (United States); 20-23 Oct 1993)			
1	18:32816	*See* BNL-NUREG–48663			
CONF-931080–		(Visualization '93; San Jose, CA (United States); 25-29 Oct 1993)			
1	18:34003	*See* SAND–93-0916C			
2	18:34010	*See* UCRL-JC–113625			
3	18:34691	*See* UCRL-JC–113626			

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CONF-931087–		(3. world conference on experimental heat transfer, fluid mechanics and thermodynamics; Honolulu, HI (United States); 31 Oct - 5 nov 1993)			
1	18:33412	*See* KAPL–4747			
CONF-931095–		(Department of Energy environmental remediation conference; Augusta, GA (United States); 24-28 Oct 1993)			
2	18:32520	*See* WSRC-MS–93-263			
CONF-931107–		(Nuclear science symposium; San Francisco, CA (United States); 2-5 Nov 1993)			
1	18:33648	*See* BNL–49016			
2	18:33690	*See* BNL–49017			
3	18:33912	OSTI; NTIS; GPO Dep.	E 1.99:	DE93015819	MF-407; MF-408
4	18:33649	*See* BNL–49160			
CONF-931108–		(Fall meeting of the Materials Research Society; Boston, MA (United States); 29 Nov - 3 dec 1993)			
1	18:32483	*See* SAND–93-1135C			
2	18:32472	*See* SAND–90-3074C			
CONF-931115–		(Supercomputing conference on high performance computing and communications; Portland, OR (United States); 15-19 Nov 1993)			
1	18:34659	*See* FNAL/C–93/076			
2	18:34678	*See* SAND–93-0936C			
3	18:34662	*See* LA-UR–93-1244			
4	18:34676	*See* SAND–93-0934C			
5	18:34677	*See* SAND–93-0935C			
6	18:34495	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93015425	MF-420
7	18:34675	*See* SAND–93-0917C			
8	18:34692	*See* UCRL-JC–113823			
CONF-931121–		(Annual winter meeting of the American Society of Mechanical Engineers; New Orleans, LA (United States); 28 Nov - 3 dec 1993)			
1	18:33416	*See* LA-UR–93-1058			
2	18:33415	*See* LA-UR–93-1057			
3	18:33414	*See* LA-UR–93-1056			
4	18:33279	*See* SAND–92-2487C			
5	18:33420	*See* SAND–93-0186C			
6	18:33990	*See* LA-UR–93-1562			
7	18:33375	*See* LA-UR–93-1938			
8	18:32901	*See* WSRC-MS–92-460			
9	18:33319	OSTI; NTIS; GPO Dep.	E 1.99:	DE93015966	MF-350
11	18:34689	*See* UCRL-JC–112716			
12	18:33398	*See* SAND–93-1495C			
13	18:33425	*See* LA-UR–93-2802			
15	18:32917	*See* EGG-M–93070			
CONF-931141–		(Radiative properties of hot dense matter; Santa Barbara, CA (United States); 2-5 Nov 1993)			
1	18:34610	*See* LA-UR–93-420			
CONF-931144–		(EFCOG: Energy Facility Cooperative Group configuration management workshop; Boston, MA (United States); 1-2 Nov 1993)			
1	18:32583	*See* WINCO–11921			
CONF-931148–		(17. annual international computer software and applications conference (COMPSAC93); Phoenix, AZ (United States); 3-5 Nov 1993)			
1	18:34698	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93010827	
CONF-931154–		(Minerals and Materials Metals Society meeting on low thermal expansion alloys and composites; Chicago, IL (United States); 1-5 Nov 1993)			
1	18:33142	*See* SAND–92-0535C			
CONF-931160–		(American Nuclear Society (ANS) winter meeting; San Francisco, CA (United States); 14-19 Nov 1993)			
2	18:32947	*See* WSRC-MS–93-178			
3	18:32922	*See* LA-UR–93-1676			
4	18:34425	*See* LA-UR–93-2429			

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5	18:34423	*See* LA-UR–93-2300			
6	18:34424	*See* LA-UR–93-2301			
8	18:32485	*See* SAND–93-1415C			
9	18:33484	*See* SAND–93-1486C			
11	18:32899	*See* SAND–93-1481C			
12	18:32591	*See* LA-UR–93-2580			
14	18:32420	*See* LA-UR–93-2261			
15	18:33792	*See* UCRL-JC–114930			
16	18:32558	*See* EGG-M–93309			
17	18:33352	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019233	MF-721
CONF-931169–		(24. Decision Sciences Institute national meeting; Washington, DC (United States); Nov 1993)			
1	18:33136	*See* SAND–93-1347C			
CONF-931180–		(6. international conference on megagauss magnetic field generation and related topics; Albuquerque, NM (United States); 8-11 Nov 1993)			
1	18:33392	*See* SAND–92-2268C			
CRTD–					
Vol.20-2	18:32771	*See* NUREG/GR–0005-Vol.2-Pt.1			
CTH-A–					
91-196	18:33777	*See* NUTEK-VK–93-4			
CTH-ED–					
146-L	18:34496	OSTI; NTIS; INIS		DE94600467	
CTH-IEFT-PP–					
1992-29	18:34497	OSTI; NTIS; INIS		DE94600434	
1993-01	18:34498	OSTI; NTIS; INIS		DE94600468	
CTH-RF–					
94	18:34416	OSTI; NTIS; INIS		DE94600425	
CTP-TAMU–					
27/93,hep-th/9307043.	18:34027	*See* IC–93/165			
CU-CS–					
617-92	18:34647	*See* DOE/ER/25122–4			
DDV–					
93-0004	18:33722	*See* UCRL-CR–114509			
DNA-TR–					
92-79	18:33728	OSTI; NTIS		DE93014451	
DOE–					
93017197	18:34699	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017197	MF-900
DOE-HDBK–					
1018/2-93	18:33343	OSTI; NTIS; GPO Dep.	E 1.99:	DE93012226	MF-506
DOE-HMIP-RR–					
90.084.	18:32352	*See* AEA-D and R–0054			
DOE/BC/14445–					
12	18:32256	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000151	PC-122
DOE/BC/14470–					
10	18:32250	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000150	PC-122
DOE/BC/14479–					
15	18:32328	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040005	MF-122
DOE/BC/14600–					
51	18:32257	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000152	PC-122
52	18:32258	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000157	PC-122
53	18:32259	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000161	PC-122
DOE/BC/14650–					
13	18:32260	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040009	MF-122
DOE/BC/14657–					
13	18:32261	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040012	MF-122
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1(Vol.1)	18:32262	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000148	PC-122
2(Vol.2)	18:32263	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000149	PC-122
DOE/BC/14853–					
4	18:32264	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040007	MF-122
DOE/BC/14883–					
3	18:32265	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040008	MF-122
DOE/BC/14955–					
1	18:32266	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019958	MF-122
DOE/BC/14956–					
1	18:32251	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019885	MF-126
DOE/BC/14958–					
3	18:32267	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040010	MF-122

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DOE/BP–					
2074	18:32962	*See* DOE/EIS–0162-Summ.			
DOE/BP/17460–					
1	18:32680	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018973	MF-902
DOE/BP/21985–					
2	18:33843	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019486	MF-902
DOE/CE–					
17712	18:32728	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016763	MF-251
DOE/CE/15464–					
T6	18:33105	OSTI; NTIS; GPO Dep.	E 1.99:	DE93041086	MF-350
DOE/CE/15501–					
T8	18:33081	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040017	MF-350
DOE/CE/15510–					
T6	18:32268	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019244	MF-220
T8	18:32269	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040514	MF-220
DOE/CE/15512–					
T8	18:33353	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016294	MF-310
DOE/CE/15517–					
T6	18:32270	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019029	MF-310
DOE/CE/15522–					
T7	18:33285	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040717	MF-310
DOE/CE/15553–					
T4	18:32271	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040365	MF-250
DOE/CE/23810–					
10	18:33291	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040215	MF-350
13-Vol.1	18:33249	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040216	MF-350
13-Vol.2	18:33250	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040217	MF-350
13-Vol.3	18:33251	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040218	MF-350
16	18:33252	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040219	MF-350
20	18:33082	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040220	MF-350
20C	18:33083	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040221	MF-350
DOE/CE/23821–					
T1	18:33084	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019344	MF-350
DOE/CH–					
9205	18:33292	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019466	MF-600
DOE/DP–					
0018-Del.Ver.	18:32540	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019187	MF-700
DOE/DP/40200–					
204	18:34530	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018333	MF-712
229	18:34531	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018334	MF-712
245	18:34532	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018335	MF-712
251	18:34533	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017618	MF-712
DOE/EA–					
0587	18:32963	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016881	MF-630
0702	18:32960	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016914	MF-630
0810	18:33713	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016910	MF-630
0822	18:32681	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016650	MF-630
0822(2)	18:32529	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017301	MF-630
0849	18:32639	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019112	MF-630
0855	18:32361	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016652	MF-700
0862	18:32961	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017296	MF-630
DOE/EE–					
0399	18:32632	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019186	MF-900
DOE/EH–					
0319	18:33470	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017933	MF-630
0326	18:32995	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017966	MF-630
0330	18:32362	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019893	MF-600
0331	18:33863	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018387	MF-607
0333	18:32363	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019210	MF-600
DOE/EI/22627–					
T2	18:32293	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019463	MF-950
DOE/EIA–					
0035(93/07)	18:33036	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE93018112	MF-950
0109(93/07)	18:32294	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE93018405	MF-950
0130(93/06)	18:32321	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE93016282	MF-950
0130(93/07)	18:32295	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE93018127	MF-950
0149(92)	18:33005	OSTI; NTIS; INIS; GPO; GPO Dep.	E 1.99:	DE93016833	MF-950
0293(93)	18:32976	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE93016987	MF-950
0380(93/06)	18:33037	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE93017681	MF-950
0380(93/07)	18:32296	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE93017435	MF-950
0380(93/08)	18:32297	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE93019384	MF-950

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
0487(92)	18:33038	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018813	MF-950
0513(93)	18:32247	OSTI; NTIS; GPO; INIS; GPO Dep.	E 1.99:	DE93018402	MF-950
0520(93/06)	18:32298	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE93016639	MF-950
0520(93/07)	18:32299	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE93018041	MF-950
0543(93/1Q)	18:33039	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE93017108	MF-950
M052	18:32322	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017833	MF-950
DOE/EIA/TR–					
0567	18:32300	OSTI; NTIS; GPO; INIS; GPO Dep.	E 1.99:	DE93018993	MF-950
DOE/EIS–					
0162-Summ.	18:32962	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017386	MF-630
0185F-387	18:32541	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019015	MF-902
DOE/EM–					
0096	18:32364	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018386	MF-940
DOE/ER–					
0144/11	18:33286	OSTI; NTIS; GPO Dep.	E 1.99:	DE93011855	PC-400; PC-401
0535P/2	18:33006	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93012401	MF-400
0590	18:34060	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017934	MF-413
0592	18:34585	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018408	MF-420
93017838	18:32640	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017838	MF-408
DOE/ER/10713–					
T5	18:34023	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93015029	MF-414
DOE/ER/12931–					
2	18:32798	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017839	MF-406
DOE/ER/13190–					
8	18:34646	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040083	MF-405
DOE/ER/13263–					
T1	18:33320	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019592	MF-401
DOE/ER/13433–					
5	18:33253	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040305	MF-404
DOE/ER/13519–					
7	18:34440	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040222	MF-411
DOE/ER/13617–					
T1	18:33321	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019988	MF-401
DOE/ER/13619–					
7	18:33322	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019892	MF-401
DOE/ER/13732–					
7	18:33217	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040364	MF-404
DOE/ER/13778–					
6	18:34441	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018717	MF-411
DOE/ER/13859–					
32	18:33323	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019460	MF-401
DOE/ER/14153–					
3	18:33971	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019587	MF-403
DOE/ER/14228–					
2	18:33338	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040874	MF-401
DOE/ER/14295–					
1	18:33324	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019698	MF-401
DOE/ER/20008–					
2	18:33861	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040691	MF-408
DOE/ER/20015–					
2	18:33856	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019889	MF-408
DOE/ER/20055–					
4	18:33857	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019884	MF-408
DOE/ER/25122–					
4	18:34647	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018337	MF-405
5	18:34648	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018336	MF-405
DOE/ER/30155–					
H1	18:33085	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019589	MF-400
DOE/ER/40150–					
211	18:33575	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017505	MF-414
212	18:33576	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017367	MF-414
214	18:34488	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017510	MF-414
219	18:33577	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014225	MF-414
220	18:33578	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014226	MF-411
223	18:34052	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017454	MF-414
224	18:33579	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017452	MF-413
226	18:33580	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017820	MF-411
227	18:33499	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017821	MF-414
T2	18:33581	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017915	MF-411

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/ER/40162–					
T6	18:33651	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018862	MF-413
DOE/ER/40270–					
42	18:34066	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019596	MF-413
DOE/ER/40285–					
6	18:34061	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018145	MF-413
T2	18:34062	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018137	MF-413
DOE/ER/40317–					
12	18:33997	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019932	MF-412
DOE/ER/40319–					
T3	18:34014	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018140	MF-414
DOE/ER/40358–					
4	18:34039	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013190	MF-414
DOE/ER/40412–					
6	18:34040	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018925	MF-414
DOE/ER/40531–					
4	18:34243	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019263	MF-413
DOE/ER/40541–					
1	18:33582	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018415	MF-406
DOE/ER/40553–					
4	18:34154	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019861	MF-413
DOE/ER/40561–					
110-INT93	18:34063	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017369	MF-413
DOE/ER/40676–					
T1	18:34015	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040875	MF-414
DOE/ER/40678–					
T1	18:33652	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019853	MF-406
DOE/ER/40682–					
23	18:34024	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018866	MF-414
DOE/ER/40684–					
3	18:34016	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018031	MF-414
DOE/ER/40702–					
3	18:33998	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017601	MF-410
4	18:34017	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018299	MF-414
DOE/ER/40704–					
2-Task-A	18:34018	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018417	MF-414
2-Task-J	18:34053	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018421	MF-414
DOE/ER/40730–					
1	18:34019	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014444	MF-414
DOE/ER/40739–					
1	18:34444	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013552	MF-414
DOE/ER/40747–					
1	18:33500	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017205	MF-414
3	18:33501	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017207	MF-414
4	18:33502	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017208	MF-414
7	18:33503	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018447	MF-414
DOE/ER/40759–					
1	18:33471	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018954	MF-414
DOE/ER/45162–					
T1	18:33154	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040078	MF-411
DOE/ER/45199–					
3	18:34460	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019461	MF-411
DOE/ER/45283–					
12	18:33254	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040690	MF-404
DOE/ER/45324–					
T3	18:34461	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018307	MF-410
DOE/ER/45326–					
T3	18:33155	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010350	MF-410
DOE/ER/45328–					
7	18:33156	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019931	MF-404
DOE/ER/45367–					
5	18:33157	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019462	MF-404
DOE/ER/45460–					
2	18:33255	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019854	MF-404
DOE/ER/52161–					
5	18:33158	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019933	MF-404
DOE/ER/53291–					
4	18:34499	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040684	MF-427
DOE/ER/54089–					
2	18:34500	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040085	MF-420

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/ER/54100–					
1-Vol.1	18:34586	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019139	MF-420
1-Vol.2	18:34587	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019140	MF-420
DOE/ER/54101–					
T1-Vol.1	18:34588	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018648	MF-415
T1-Vol.2	18:34589	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018647	MF-415
T1-Vol.3	18:34590	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018675	MF-415
DOE/ER/60390–					
T2	18:33913	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019590	MF-408
DOE/ER/60872–					
T2	18:32621	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017832	MF-406
DOE/ER/61029–					
14	18:33961	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040689	MF-401
DOE/ER/61226–					
2	18:33864	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019597	MF-408
DOE/ER/61235–					
T1	18:33858	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019986	MF-408
DOE/ER/61256–					
T1	18:33914	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040079	MF-408
DOE/ER/75667–					
1	18:33007	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019883	MF-400
DOE/ER/75748–					
1	18:32825	OSTI; NTIS; GPO Dep.	E 1.99:	DE93015783	MF-400
DOE/ER/75781–					
1	18:32817	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017906	MF-406
DOE/ET/51013–					
T248	18:34501	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017617	MF-426
DOE/ET/53088–					
546	18:34502	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040319	MF-424
609	18:34503	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040320	MF-421
616	18:34504	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040318	MF-422
DOE/EW/50616–					
T13	18:33700	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019890	MF-906
DOE/FE–					
0275	18:32301	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018119	MF-126
0279	18:32749	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016718	MF-111
DOE/FTR–					
93011426	18:34489	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93011426	MF-704
93011430	18:34591	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93011430	MF-520
93011811	18:32908	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93011811	MF-520
93012116	18:33583	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93012116	MF-414
93012117	18:32783	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93012117	MF-700
93012256	18:32784	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93012256	MF-900
93012690	18:32996	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93012690	MF-220; MF-231; MF-234
93013013	18:32796	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93013013	MF-500
93013015	18:32909	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93013015	MF-500
93013397	18:32800	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93013397	MF-900
93013405	18:33704	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93013405	MF-700
93013406	18:33729	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93013406	MF-700
93013407	18:32910	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93013407	MF-507
93013560	18:33354	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93013560	MF-906
93013717	18:33730	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93013717	MF-700
93013880	18:32738	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93013880	MF-261
93014001	18:34592	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014001	MF-420
93014002	18:34462	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014002	MF-712
93014205	18:32911	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014205	MF-520
93014207	18:32970	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014207	MF-700
93014404	18:32622	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014404	MF-508; MF-520
93014492	18:33355	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014492	MF-700
93014497	18:33293	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014497	MF-401
93014639	18:32365	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014639	MF-510
93014640	18:33653	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014640	MF-414
93014641	18:32912	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014641	MF-500
93014671	18:32826	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014671	MF-520
93014672	18:33086	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014672	MF-231
93014673	18:33008	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014673	MF-700
93014685	18:32634	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014685	MF-704
93014686	18:32913	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014686	MF-500

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
93014687	18:33256	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014687	MF-704
93014688	18:32542	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014688	MF-506
93014689	18:32212	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014689	MF-112
93014690	18:32213	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014690	MF-113
93014691	18:32214	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014691	MF-113
93014703	18:33050	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014703	MF-112
93014704-Vol.1-2	18:32198	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014704	MF-105
93014775	18:33409	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014775	MF-117
93014796	18:33356	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014796	MF-706
93014802	18:32248	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014802	MF-102
93014804	18:32366	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014804	MF-902
93014805	18:32682	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014805	MF-270
93014806	18:34593	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014806	MF-420
93014807	18:32215	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014807	MF-101
93014810	18:33757	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014810	MF-906
93014812	18:32914	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014812	MF-520
93014813	18:33133	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014813	MF-706
93014814	18:33654	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014814	MF-414
93014867	18:33801	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014867	MF-940
93014868	18:32367	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014868	MF-900
93014869	18:32543	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014869	MF-607
93014870	18:32683	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014870	MF-270
93014871	18:32775	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014871	MF-402
93014872	18:33004	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014872	MF-900
93014873	18:33472	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014873	MF-414
93014982	18:34025	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014982	MF-414
93014984	18:32705	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014984	MF-231; MF-232
93015191	18:33758	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015191	MF-262
93015192	18:33844	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015192	MF-610
93015193	18:33759	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015193	MF-603
93015194	18:32216	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015194	MF-101
93015250	18:32693	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015250	ND-270
93015301	18:33705	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015301	MF-700
93015302	18:34594	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015302	MF-706
93015303	18:32368	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015303	MF-940
93015323	18:34631	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015323	MF-270
93015325	18:32734	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015325	MF-261
93015528	18:33706	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015528	MF-700
93015529	18:32544	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015529	MF-902
93015530	18:34649	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015530	MF-400
93015635	18:33731	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015635	MF-700
93015636	18:34417	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015636	MF-700
93015637	18:33760	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015637	MF-262
93015807	18:32369	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015807	MF-814
93015950	18:34020	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015950	MF-414
93015951	18:33357	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015951	MF-700
93015952	18:34595	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015952	MF-422
93015993	18:32370	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015993	MF-810
93015994	18:32205	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015994	MF-101
93016207	18:32206	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93016207	MF-105
93016211	18:33972	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93016211	MF-702
93016212	18:34041	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93016212	MF-414
93016213	18:33915	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93016213	MF-707
93016247	18:32694	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93016247	MF-270
93016248	18:32739	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93016248	MF-261
93016249	18:33802	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93016249	MF-902
93016513	18:32359	*See* CONF-8910364–Vol.2			
93016673	18:33048	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93016673	MF-350
93016756	18:32641	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93016756	MF-247
93016757	18:33916	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93016757	MF-507
93016758	18:33917	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93016758	MF-507
93016772	18:33473	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93016772	MF-414
93016797	18:34596	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93016797	MF-423
93017128	18:32371	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017128	MF-940
93017130	18:32696	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017130	MF-235
93017243	18:32372	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017243	MF-940
93017244	18:33584	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017244	MF-406
93017245	18:33918	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017245	MF-507
93017246	18:33585	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017246	MF-413
93017247	18:32977	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017247	MF-201

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
93017248	18:33474	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017248	MF-414
93017249	18:32373	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017249	MF-940
93017250	18:33342	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017250	MF-400
93017251	18:32750	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017251	MF-105
93017252	18:34597	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017252	MF-421
93017253	18:34598	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017253	MF-421
93017254	18:33761	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017254	MF-902
93017255	18:32156	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017255	MF-108
93017307	18:32217	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017307	MF-105
93017318	18:32208	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017318	MF-102
93017322	18:33257	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017322	MF-704
93017323	18:32218	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017323	MF-104
93017324	18:33051	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017324	MF-112
93017325	18:32319	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017325	MF-108
93017327	18:33762	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017327	MF-262
93017328	18:33113	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017328	MF-247
93017470	18:32207	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017470	MF-101
93017471	18:32219	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017471	MF-101
93017869	18:32751	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017869	MF-103
93018108	18:32545	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93018108	MF-721; MF-708
93018609	18:33803	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93018609	MF-903
93018610	18:32157	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93018610	MF-105
93018986	18:34700	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93018986	MF-705
93018987	18:33087	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93018987	MF-402
93019138	18:34599	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019138	MF-420
93019182	18:32338	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019182	MF-940
93019284	18:32220	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019284	MF-113
DOE/ID–					
10347	18:32374	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016685	MF-900
12082(92)	18:33919	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018935	MF-502
22107	18:33804	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019032	
DOE/ID/12735–					
T27	18:32546	OSTI; NTIS; GPO Dep.	E 1.99:	DE93041038	MF-112
DOE/ID/13215–					
T1	18:32375	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040363	MF-903
DOE/LLW–					
144	18:32376	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017394	MF-902
161	18:32801	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013739	MF-906
170	18:32377	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017395	MF-902
DOE/MC/10637–					
3365	18:32221	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000282	MF-113
DOE/MC/11076–					
3385	18:32329	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019995	MF-123
3435	18:32158	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040679	MF-123
DOE/MC/11089–					
3388	18:32330	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040362	MF-123
DOE/MC/22118–					
3413	18:32199	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040361	MF-107; MF-113
DOE/MC/23075–					
3391	18:32159	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040350	MF-109; MF-111
DOE/MC/23295–					
3368	18:32222	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000285	PC-103
DOE/MC/24132–					
3416	18:32223	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040355	MF-103
DOE/MC/24167–					
3393	18:32160	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040351	MF-109
3417	18:32161	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040357	MF-109
DOE/MC/25049–					
3372	18:32224	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000292	MF-103
DOE/MC/26031–					
3442	18:32272	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040682	MF-122
DOE/MC/28080–					
3381	18:32315	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019887	MF-132
3382	18:32316	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019888	MF-132
DOE/MC/29109–					
3356	18:33294	OSTI; NTIS; GPO Dep.	E 1.99:	DE93041217	MF-902
3392	18:33805	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040019	MF-902

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/MC/29116–					
3406	18:33763	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019992	MF-902
DOE/MC/29226–					
3407	18:32675	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040002	MF-132; MF-113
3408	18:33325	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040001	MF-113; MF-132
DOE/MC/29240–					
3396	18:32331	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040367	MF-123
DOE/MC/29254–					
3398	18:32225	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040021	MF-103
DOE/MC/29444–					
3403	18:32752	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019999	MF-109
DOE/METC–					
93/4112	18:33058	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000281	MF-110
93/4113	18:32226	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000263	MF-103
DOE/MT/92011–					
4	18:32303	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040028	MF-122
DOE/MT/92012–					
4	18:32309	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040027	MF-122
DOE/MWIP–					
9	18:32378	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019953	MF-940; MF-902
10	18:32379	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019952	MF-902
DOE/NE/32115–					
T1	18:33055	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017020	MF-506
DOE/NV–					
353	18:32997	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018393	MF-707
DOE/NV/10630–					
T6	18:33732	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016196	MF-700
DOE/NV/10872–					
11	18:32380	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018957	MF-814
T61	18:34447	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018961	MF-800
DOE/OR–					
01-1122-D3	18:32547	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017914	MF-902
01-1128-D1	18:32548	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017234	MF-902
01-1135-D2	18:32381	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016908	MF-902
01-1168-D1	18:32549	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017755	MF-940
03-1150-D1	18:32382	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016909	MF-902
1060-D3	18:32550	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018593	MF-902
DOE/OR/21548–					
387	18:32541	*See* DOE/EIS–0185F-387			
DOE/OR/21949–					
367	18:32530	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018599	MF-902
368	18:32551	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018600	MF-902
369	18:32552	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018338	MF-902
DOE/OR/21971–					
T1	18:32553	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040978	MF-403
DOE/OR/21981–					
T1	18:32554	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018148	MF-607
DOE/OSTI–					
11633/4	18:33106	OSTI; NTIS; GPO Dep.	E 1.99:	DE93011440	MF-310
8200-R56	18:32770	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93015065	PC-500; PC-522; PC-523; PC-530
DOE/PC/30071–					
T7	18:32753	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040676	MF-104
DOE/PC/79796–					
T33	18:32227	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040711	MF-105
DOE/PC/79916–					
3	18:32228	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019445	MF-113
DOE/PC/81004–					
T5	18:32758	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040707	MF-105
DOE/PC/88858–					
T10	18:32759	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019441	MF-105
T11	18:33764	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019440	MF-105
T12	18:33765	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019400	MF-105
T13	18:32200	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019376	MF-105
DOE/PC/88921–					
16	18:32187	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019459	MF-102

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/PC/89652–					
T10	18:32760	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017845	MF-105
DOE/PC/89653–					
T7	18:32229	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018900	MF-105
DOE/PC/89778–					
T11	18:32230	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019454	MF-105
T13	18:32231	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019456	MF-105
T9	18:32761	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019452	MF-105
DOE/PC/89785–					
14	18:33326	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019778	MF-113
DOE/PC/89786–					
T17	18:32676	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019784	MF-108
DOE/PC/89804–					
5	18:32232	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018714	PC-104
DOE/PC/89865–					
T8	18:32162	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018885	PC-108
DOE/PC/90258–					
T12	18:32188	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019447	MF-104
T13	18:32233	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019448	MF-104
DOE/PC/90274–					
T21	18:33052	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040521	MF-112
T22	18:33053	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040520	MF-112
T23	18:33054	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040519	MF-112
DOE/PC/90293–					
T9	18:32163	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019783	MF-113
DOE/PC/90308–					
9	18:32189	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019781	MF-102
10	18:32190	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040614	MF-102
DOE/PC/90309–					
11	18:32762	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040618	MF-105
DOE/PC/90546–					
T8	18:32763	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040522	MF-105
DOE/PC/90547–					
T11	18:32234	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040712	MF-104
DOE/PC/90548–					
T9	18:32764	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040516	MF-105
DOE/PC/91028–					
T6	18:32677	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040517	MF-108
DOE/PC/91039–					
T6	18:32164	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018896	MF-108
DOE/PC/91040–					
21	18:32165	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018921	MF-108
DOE/PC/91154–					
T5	18:32754	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019785	MF-104
DOE/PC/91284–					
6	18:32249	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019562	MF-117
DOE/PC/91288–					
T8	18:32166	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040633	MF-102
DOE/PC/91292–					
T7	18:32235	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040612	MF-104
DOE/PC/91295–					
T7	18:32201	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040627	MF-107
DOE/PC/91296–					
7	18:32191	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019780	MF-113
DOE/PC/91298–					
7	18:33327	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019748	MF-102
DOE/PC/91301–					
7	18:33328	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040616	MF-102
DOE/PC/91310–					
T6	18:32167	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040710	MF-108
DOE/PC/92109–					
T1	18:33329	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040631	MF-121
DOE/PC/92112–					
T2	18:33330	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040630	MF-108
DOE/PC/92117–					
T3	18:32678	OSTI; NTIS; GPO Dep.	E 1.99:	DE93041243	MF-108
DOE/PC/92521–					
T36	18:32236	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019786	MF-105
T37	18:32237	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019787	MF-105
T38	18:32168	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019788	MF-105
T39	18:32169	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019789	MF-105

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
T40	18:32192	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019790	MF-105
T41	18:32765	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019791	MF-105
T42	18:32202	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019792	MF-105
T43	18:32203	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019793	MF-105
T44	18:32193	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019794	MF-105
T45	18:32194	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019795	MF-105
T46	18:32195	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019796	MF-105
T47	18:32196	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019797	MF-105
T48	18:32170	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019798	MF-105
T49	18:33107	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019799	MF-105
T50	18:32238	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019800	MF-105
T51	18:32766	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019801	MF-105
T52	18:32239	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019802	MF-105
T53	18:32150	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019803	MF-105
T54	18:32151	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019804	MF-105
T55	18:32171	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019805	MF-102
T56	18:32172	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019806	MF-105
T57	18:32173	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019807	MF-105
T58	18:32174	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019808	MF-105
T59	18:32175	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019809	MF-109
T60	18:32197	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019810	MF-109
T61	18:32152	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019811	MF-102
T62	18:32153	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019812	MF-102
T63	18:32240	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019813	MF-103
T64	18:32176	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019814	MF-105
T65	18:32177	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019815	MF-105
T66	18:32178	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019816	MF-109
DOE/PC/92535–					
T3	18:32204	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040620	MF-104
DOE/PE/17060–					
T1	18:34632	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018605	MF-610
DOE/RL–					
88-41-Rev.2-Vol.1	18:32555	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019307	MF-630; MF-721
90-49	18:32383	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018406	MF-630; MF-721
92-24-Vol.1-Rev.1	18:32384	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017682	MF-630; MF-721
92-72-Rev.1	18:32385	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040412	MF-903
93-08	18:32386	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019979	MF-900
93-36	18:32531	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018737	MF-920
93-39	18:32387	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019977	MF-902
93-40	18:32388	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018733	MF-600
93-41	18:32389	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018732	MF-600
93-42	18:33748	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018730	MF-630
93-56-1	18:32532	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019319	MF-702
DOE/RL/11978–					
T1-Vol.1	18:33358	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018424	MF-900
T1-Vol.11	18:33369	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018433	MF-900
T1-Vol.12	18:33370	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018434	MF-900
T1-Vol.2	18:33359	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018423	MF-900
T1-Vol.3	18:33360	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018422	MF-900
T1-Vol.4	18:33361	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018425	MF-900
T1-Vol.5	18:33362	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018426	MF-900
T1-Vol.6	18:33363	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018427	MF-900
T1-Vol.7	18:33364	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018428	MF-900
T1-Vol.8-Bk.1	18:33365	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018432	MF-900
T1-Vol.8-Bk.2	18:33366	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018431	MF-900
T1-Vol.9-Bk.1	18:33367	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018430	MF-900
T1-Vol.9-Bk.2	18:33368	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018429	MF-900
DOE/RW–					
93016760	18:32391	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016760	MF-814
DOE/RW/00214–					
T1	18:32209	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019090	MF-800
T2	18:33973	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019208	MF-800
DOE/RW/00273–					
T1	18:32390	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019262	MF-810
DOE/SF/16306–					
37	18:32706	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040905	MF-231
DOE/SR/18035–					
T1-Vol.1	18:32915	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019364	MF-1000

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T1-Vol.2	18:32916	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019365	MF-1000
DOE/WIPP–					
89-003-Rev.1-Vol.1	18:32392	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018051	MF-721
89-003-Rev.1-Vol.6	18:32393	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018056	MF-721
89-003-Rev.1-Vol.7	18:32394	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018057	MF-721
89-003-Rev.1-Vol.8	18:32395	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018058	MF-721
89-003-Summ.	18:32396	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018040	MF-721
91-027C	18:32343	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017908	MF-721
91-033C	18:32397	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017916	MF-721
91-038C	18:32398	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017918	MF-903; MF-905
91-040C	18:32399	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017919	MF-902
91-045C	18:32400	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017921	ND-721
91-062C	18:32401	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017923	MF-702; MF-721
92-006C	18:32402	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017925	MF-721
92-009C	18:32403	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017926	MF-721
92-014C	18:32404	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017927	MF-721
92-044C	18:32405	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017930	MF-721
DPE–					
3481	18:32406	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019310	MF-706
DPSP–					
53-1-9-Del.Ver.	18:32827	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015756	MF-700
53-1-Del.Ver.	18:32828	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93016080	MF-700
54-1-4-Del.Ver.	18:32829	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93016025	MF-700
57-1-8-Del.Ver.	18:32830	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93016010	MF-700
59-1-1-Del.Ver.	18:32831	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93016008	MF-700
59-1-2-Del.Ver.	18:32832	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93016007	MF-700
88-Del.Ver.	18:32833	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93016078	MF-700
DPST–					
62-200-Vol.3	18:33733	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93016674	MF-700
75-487	18:32407	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019311	MF-706
84-385	18:32339	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019831	MF-701
DTH-AEF-NT–					
4	18:32785	OSTI; NTIS; INIS		DE94600277	
DTH-IVBT–					
71	18:32998	OSTI; NTIS		DE93525250	
ECN–					
89-91	18:32936	*See* NUREG/IA–0091			
ECN-C–					
92-008	18:32938	*See* NUREG/IA–0112			
93-021	18:32999	OSTI; NTIS; Available from the library of the Netherlands Energy Research Foundation (ECN), P.O. Box 1, 1755 ZG Petten (Netherlands)		DE93524591	
93-029	18:32978	OSTI; NTIS; Available from the library of the Netherlands Energy Research Foundation (ECN), P.O. Box 1, 1755 ZG Petten (Netherlands)		DE93524592	
93-030	18:32979	OSTI; NTIS; Available from the library of the Netherlands Energy Research Foundation (ECN), P.O. Box 1, 1755 ZG Petten (Netherlands)		DE93524593	
93-031	18:33030	OSTI; NTIS; Available from the library of the Netherlands Energy Research Foundation (ECN), P.O. Box 1, 1755 ZG Petten (Netherlands)		DE93524594	
93-032	18:33009	OSTI; NTIS; Available from the library of the Netherlands Energy Research Foundation (ECN), P.O. Box 1, 1755 ZG Petten (Netherlands)		DE93524595	
ECN-I–					
93-028	18:32740	OSTI; NTIS; Available from the library of the Netherlands Energy Research Foundation (ECN), P.O. Box 1, 1755 ZG Petten (Netherlands)		DE93524589	
ECN-R–					
93-006	18:32741	OSTI; NTIS; Available from the library of the Netherlands Energy Research Foundation (ECN), P.O. Box 1, 1755 ZG Petten (Netherlands)		DE93524599	

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ECN-RX–					
93-053	18:33806	OSTI; NTIS; Available from the library of the Netherlands Energy Research Foundation (ECN), P.O. Box 1, 1755 ZG Petten (Netherlands)		DE93524584	
93-067	18:32241	OSTI; NTIS; Available from the library of the Netherlands Energy Research Foundation (ECN), P.O. Box 1, 1755 ZG Petten (Netherlands)		DE93524585	
93-068	18:32242	OSTI; NTIS; Available from the library of the Netherlands Energy Research Foundation (ECN), P.O. Box 1, 1755 ZG Petten (Netherlands)		DE93524586	
93-071	18:32980	OSTI; NTIS; Available from the library of the Netherlands Energy Research Foundation (ECN), P.O. Box 1, 1755 ZG Petten (Netherlands)		DE93524587	
93-083	18:33059	OSTI; NTIS; Available from the library of the Netherlands Energy Research Foundation (ECN), P.O. Box 1, 1755 ZG Petten (Netherlands)		DE93524596	
93-086	18:32742	OSTI; NTIS; Available from the library of the Netherlands Energy Research Foundation (ECN), P.O. Box 1, 1755 ZG Petten (Netherlands)		DE93524588	
93-087	18:32743	OSTI; NTIS; Available from the library of the Netherlands Energy Research Foundation (ECN), P.O. Box 1, 1755 ZG Petten (Netherlands)		DE93524597	
93-088	18:32744	OSTI; NTIS; Available from the library of the Netherlands Energy Research Foundation (ECN), P.O. Box 1, 1755 ZG Petten (Netherlands)		DE93524598	
EGG–					
10617-1219	18:33807	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019093	
10617-2155	18:33808	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018484	
10617-2159	18:33855	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018483	MF-702
10617-2195	18:32408	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018485	MF-814
EGG-BNCT–					
10764-3/4	18:33865	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019028	MF-408
EGG-CEE–					
10818	18:32306	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018978	
EGG-EEL–					
10794	18:32556	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018934	MF-903
EGG-FSP–					
9971	18:34600	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019025	MF-419
EGG-GEO–					
10797	18:32409	OSTI; NTIS (documentation only); ESTSC (complete software package), P.O. Box 1020, Oak Ridge, TN 37831-1020; INIS; GPO Dep.	E 1.99:	DE93019026	MF-902
EGG-M–					
93052	18:34633	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018998	MF-500
93070	18:32917	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018997	
93100	18:33371	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018948	MF-820
93238	18:32557	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018942	MF-600
93267	18:32340	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018944	MF-523
93309	18:32558	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018999	MF-907
EGG-NPR–					
10689	18:32819	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019034	MF-1002
10690	18:32723	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019033	MF-1002
10691-App.1-3	18:33974	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019051	MF-1000
10691-App.4-Pt.1	18:33975	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019052	MF-1000
10691-App.4-Pt.2	18:33976	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019053	MF-1000
10691-App.4-Pt.3	18:33977	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019054	MF-1000

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EGG-PIR–					
10633(1Q-93)	18:32918	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018931	MF-500
EGG-WMO–					
10321	18:32410	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019005	MF-902
EGG-WTD–					
10716	18:32559	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018990	MF-900
EI–					
0788-017	18:32160	*See* DOE/MC/24167–3393			
EML–					
556	18:33766	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019732	MF-900
ENEA-RT-AMB–					
92-02	18:32411	OSTI; NTIS (US Sales Only)		DE93522947	
92-05	18:32671	OSTI; NTIS (US Sales Only); INIS		DE93522971	
92-10	18:32672	OSTI; NTIS (US Sales Only)		DE93522970	
ENEA-RT-DISP–					
91-04	18:33372	OSTI; NTIS (US Sales Only)		DE93522957	
ENEA-RT-ENERG–					
91-07	18:34650	OSTI; NTIS (US Sales Only)		DE93522951	
ENEA-RT-INN–					
91-02	18:32684	OSTI; NTIS (US Sales Only)		DE93522940	
92-16	18:34601	OSTI; NTIS (US Sales Only)		DE93522934	
92-22	18:33258	OSTI; NTIS (US Sales Only)		DE93522942	
92-29	18:33436	OSTI; NTIS (US Sales Only)		DE93522943	
92-34	18:34701	OSTI; NTIS (US Sales Only)		DE93522945	
92-36	18:33295	OSTI; NTIS (US Sales Only)		DE93522941	
92-41	18:33809	OSTI; NTIS (US Sales Only); INIS		DE93522949	
ENEA-RT-NUCL–					
91-09	18:33410	OSTI; NTIS (US Sales Only)		DE93522948	
92-01	18:33767	OSTI; NTIS (US Sales Only)		DE93522944	
92-24	18:34603	OSTI; NTIS (US Sales Only)		DE93522980	
ENEA-RTI-ENE-FORI–					
92-01	18:32736	OSTI; NTIS (US Sales Only); INIS		DE93522996	
ENEA-RTI-INN–					
92-16	18:34505	OSTI; NTIS (US Sales Only)		DE93522950	
ENEA-RTI-NUCL-FUS–					
92-01	18:34602	OSTI; NTIS (US Sales Only)		DE93523003	
ENEA-RTI-STUDI-ENE–					
92-04	18:33122	OSTI; NTIS (US Sales Only)		DE93522966	
ERA-NRE–					
93-034	18:32834	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018946	MF-520
ES/CSET–					
18	18:32560	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017990	MF-407
ES/ER–					
17-D1/R1	18:32381	*See* DOE/OR–01-1135-D2			
ES/ER/TM–					
1/R2	18:32561	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017754	MF-902
ESTSC–					
000182AL00000	18:34651	ESTSC			
000218IBMPC02	18:34652	ESTSC			
000324IB38600	18:34653	ESTSC; Lawrence Livermore National Lab			
000324IB48600	18:34654	ESTSC; Lawrence Livermore National Lab			
000581IBMPC01	18:34655	ESTSC			
000593IBMPC00	18:34656	ESTSC			
000601IBMPC00	18:34657	ESTSC			
000608IBMPC00	18:34658	ESTSC			
ETDE-IT–					
93-196	18:33655	OSTI; NTIS (US Sales Only)		DE93522930	
93-197	18:33125	OSTI; NTIS (US Sales Only)		DE93522935	
93-199	18:33259	OSTI; NTIS (US Sales Only)		DE93523004	
93-200	18:33118	OSTI; NTIS (US Sales Only)		DE93522937	
93-201	18:33920	OSTI; NTIS (US Sales Only)		DE93522946	
93-202	18:32802	OSTI; NTIS (US Sales Only)		DE93522952	
93-203	18:34494	OSTI; NTIS (US Sales Only)		DE93522953	
93-204	18:33437	OSTI; NTIS (US Sales Only)		DE93522954	
93-205	18:33159	OSTI; NTIS (US Sales Only)		DE93523005	
93-206	18:33845	OSTI; NTIS (US Sales Only)		DE93522958	
93-207	18:34604	OSTI; NTIS (US Sales Only)		DE93522959	
93-208	18:33965	OSTI; NTIS (US Sales Only); INIS		DE93522967	
93-209	18:33921	OSTI; NTIS (US Sales Only)		DE93522968	
93-210	18:33922	OSTI; NTIS (US Sales Only)		DE93522974	
93-211	18:33923	OSTI; NTIS (US Sales Only)		DE93522975	

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ETDE-IT–					
93-212	18:34605	OSTI; NTIS (US Sales Only)		DE93522977	
93-213	18:34606	OSTI; NTIS (US Sales Only)		DE93522981	
93-214	18:32984	OSTI; NTIS (US Sales Only)		DE93522983	
93-215	18:32985	OSTI; NTIS (US Sales Only); INIS		DE93522984	
93-216	18:33010	OSTI; NTIS (US Sales Only)		DE93522985	
93-217	18:33011	OSTI; NTIS (US Sales Only)		DE93522986	
93-218	18:33018	OSTI; NTIS (US Sales Only)		DE93522987	
ETDE/JP-mf–					
93520769	18:32724	OSTI; NTIS; Available from Geological Survey of Japan, 1-3, Higashi 1-chome, Tsukuba-shi, Ibaraki, Japan		DE93520769	
ETSU-B/FW–					
00239/REP	18:32642	OSTI; NTIS (US Sales Only)		DE93516761	
ETSU-B/MS–					
00192/20/REP	18:32643	OSTI; NTIS (US Sales Only)		DE93516762	
ETSU-R–					
72	18:32733	OSTI; NTIS (US Sales Only)		DE93798223	
ETSU-S–					
1160/17	18:32707	OSTI; NTIS (US Sales Only)		DE93515076	
1160/SBS/16	18:32708	OSTI; NTIS (US Sales Only)		DE93502502	
1160/SBS/19	18:32709	OSTI; NTIS (US Sales Only)		DE93502503	
1160/SBS/26	18:32710	OSTI; NTIS (US Sales Only)		DE93502504	
ETSU-TID–					
4112	18:32732	OSTI; NTIS (US Sales Only); INIS		DE93515075	
FEMP–					
2290	18:32562	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019497	MF-707
FEMP/SUB–					
066	18:33846	OSTI; NTIS; GPO Dep.	E 1.99:	DE93015654	MF-702
FNAL-TM–					
1790	18:33587	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017814	MF-414
1791	18:33588	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017813	MF-414
1836	18:33589	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014015	MF-414
1847	18:33590	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017815	MF-400
FNAL/C–					
93/076	18:34659	OSTI; NTIS; GPO Dep.	E 1.99:	DE93012128	MF-405
93/088	18:34042	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017809	MF-414
93/111	18:33475	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017261	MF-414
93/120	18:33504	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017260	MF-414
93/125	18:33639	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017804	MF-414
93/132	18:33586	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017807	MF-414
93/156	18:33476	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017811	MF-407
93/157-E	18:34026	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017812	MF-414
93/163-E	18:34031	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017805	MF-414
93/166-E	18:34043	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017810	MF-414
93/173	18:33505	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017806	MF-414
FSU-SCRI–					
93-31	18:34455	*See* CONF-9302137–1			
GRI–					
93/0109	18:32317	*See* SAND–93-7042			
GRS–					
101	18:32939	*See* NUREG/IA–0127			
GTFR–					
108	18:34506	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018039	MF-420
HAN–					
10012	18:32853	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019675	MF-700
11152	18:32854	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019644	MF-700
11206	18:32855	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019645	MF-700
11465	18:32856	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019646	MF-700
12091	18:32857	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019647	MF-700
12164	18:32858	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019648	MF-700
12573	18:32859	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019649	MF-700
12747	18:32860	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019650	MF-700
13304	18:32861	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019651	MF-700
13496	18:32862	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019653	MF-700
13728	18:32863	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019652	MF-700
14412	18:32864	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019654	MF-700
14572	18:32865	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019655	MF-700
14720	18:32866	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019656	MF-700
15068	18:32867	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019657	MF-700
15218	18:32868	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019658	MF-700
15464	18:32869	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019659	MF-700

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15784	18:32870	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019635	MF-700
15937	18:32871	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019636	MF-700
16217	18:32872	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019637	MF-700
16762	18:32873	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019639	MF-700
17159	18:32874	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019640	MF-700
17375	18:32875	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019641	MF-700
17665	18:32876	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019642	MF-700
17938	18:32877	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019643	MF-700
18849	18:32878	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019704	MF-700
19118	18:32879	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019705	MF-700
19394	18:32880	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019706	MF-700
20229	18:32881	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019708	MF-700
20497	18:32882	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019709	MF-700
2142	18:32835	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019676	MF-700
21448	18:32883	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019712	MF-700
2289	18:32836	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019677	MF-700
2297	18:32837	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019678	MF-700
23207	18:32884	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019717	MF-700
23426	18:32885	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019718	MF-700
23866	18:32886	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019719	MF-700
24137	18:32887	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019720	MF-700
24860	18:32888	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019722	MF-700
25585	18:32889	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019724	MF-700
25824	18:32890	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019725	MF-700
26190	18:32891	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019726	MF-700
2678	18:32838	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019660	MF-700
2992	18:32839	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019661	MF-700
3099	18:32840	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019662	MF-700
3605	18:32841	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019663	MF-700
3845	18:32842	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019664	MF-700
4134	18:32843	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019665	MF-700
4714	18:32844	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019666	MF-700
4804	18:32845	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019667	MF-700
4926	18:32846	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019669	MF-700
5158	18:32847	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019670	MF-700
5491	18:32848	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019671	MF-700
5738	18:32849	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019672	MF-700
6013	18:32850	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019668	MF-700
6252	18:32851	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019673	MF-700
6748	18:32852	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019674	MF-700
HEDL-TC–					
2273	18:33373	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019984	MF-700
HIFAN–					
568	18:33608	*See* LBL–33283			
569	18:34612	*See* LBL–33284			
570	18:33507	*See* LBL–33285			
571	18:33508	*See* LBL–33286			
572	18:34613	*See* LBL–33287			
574	18:34614	*See* LBL–33289			
575	18:33613	*See* LBL–33315			
583	18:34615	*See* LBL–33804			
HW–					
19296	18:33924	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017357	MF-507
28308	18:32892	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017355	MF-520
34868-Ch.11	18:32893	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019817	MF-504
54972	18:32894	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93041258	MF-711
70700	18:32563	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017377	MF-520; MF-507
75700-Del.	18:32895	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014281	MF-500
HWVP–					
89-001-Rev.1	18:32412	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018729	MF-940
89-007-Rev.3	18:32413	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018409	MF-940
IAEA-CN–					
56/E-1-4	18:34520	*See* UCRL-JC–109884			
IAEA-SM–					
329/21/0	18:33810	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93015888	MF-402
IAEA-TECDOC–					
708	18:33872	OSTI; NTIS (US Sales Only); INIS		DE94600178	
IAEA/UNDP–					
INS/88/013-11	18:33890	OSTI; NTIS (US Sales Only); INIS		DE94600160	
INS/88/013-13	18:33891	OSTI; NTIS (US Sales Only); INIS		DE94600179	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
IAEA/UNDP–					
INS/88/013-14	18:33892	OSTI; NTIS (US Sales Only); INIS		DE94600150	
INS/88/013-15	18:33893	OSTI; NTIS (US Sales Only); INIS		DE94600180	
THA/85/004-17	18:33894	OSTI; NTIS (US Sales Only); INIS		DE94600151	
THA/85/004-18	18:33895	OSTI; NTIS (US Sales Only); INIS		DE94600152	
THA/85/004-19	18:33896	OSTI; NTIS (US Sales Only); INIS		DE94600153	
THA/85/004-20	18:33897	OSTI; NTIS (US Sales Only); INIS		DE94600181	
THA/85/004-21	18:33898	OSTI; NTIS (US Sales Only); INIS		DE94600182	
THA/85/004-22	18:33899	OSTI; NTIS (US Sales Only); INIS		DE94600154	
IC–					
93/165	18:34027	OSTI; NTIS (US Sales Only); INIS		DE94600358	
ICSP–					
TR-TTRIP-R	18:32935	*See* NUREG/IA–0085			
IEE-SR–					
241	18:33040	OSTI; NTIS; Available from The Institute of Energy Economics, Dai 10 Mori Biru, 18-1, Toranomon 1-chome, Minato-ku, Tokyo,Japan		DE93520813	
IFE/KR/E–					
93/004	18:33411	OSTI; NTIS		DE93525281	
IFE/KR/F–					
93/094	18:32252	OSTI; NTIS		DE93525283	
IFRF-Doc-G–					
20/y/3	18:32643	*See* ETSU-B/MS–00192/20/REP			
IFRF-F–					
99/y/1	18:32314	OSTI; NTIS; Also available from IFRF, P.O. Box 10000, 1970 CA IJmuiden (Netherlands)		DE93524748	
IFSR–					
546	18:34502	*See* DOE/ET/53088–546			
609	18:34503	*See* DOE/ET/53088–609			
616	18:34504	*See* DOE/ET/53088–616			
IHEP-OTF–					
91-176	18:33656	OSTI; NTIS (US Sales Only); INIS		DE94600285	
INDC(CPR)–					
027/L.	18:34415	*See* CNIC–00645			
INIS-GB–					
492	18:32776	OSTI; NTIS (US Sales Only); INIS		DE94600270	
493	18:32341	OSTI; NTIS (US Sales Only); INIS		DE94600065	
INIS-mf–					
13548	18:32803	OSTI; NTIS (US Sales Only); INIS		DE94600002	
13549	18:32804	OSTI; NTIS (US Sales Only); INIS		DE94600067	
13676	18:32533	OSTI; NTIS (US Sales Only); INIS		DE93633757	
13679	18:33900	OSTI; NTIS (US Sales Only); INIS		DE94600171	
13682	18:33019	OSTI; NTIS (US Sales Only); INIS		DE94600317	
13683	18:33902	OSTI; NTIS (US Sales Only); INIS		DE94600172	
13684	18:33903	OSTI; NTIS (US Sales Only); INIS		DE94600161	
13685	18:33904	OSTI; NTIS (US Sales Only); INIS		DE94600162	
13686	18:33905	OSTI; NTIS (US Sales Only); INIS		DE94600155	
13687	18:33906	OSTI; NTIS (US Sales Only); INIS		DE94600156	
13688	18:33907	OSTI; NTIS (US Sales Only); INIS		DE94600157	
13689	18:33908	OSTI; NTIS (US Sales Only); INIS		DE94600173	
13690	18:34634	OSTI; NTIS; INIS		DE94600345	
INS–					
965	18:34032	OSTI; NTIS; INIS		DE93520239	
IR-CR–					
93074	18:32307	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019476	
IRF–					
211	18:34509	OSTI; NTIS; INIS		DE94600492	
IS-M–					
747	18:33271	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93011562	MF-404
J–					
204-93-0052/2789	18:33283	*See* UCRL-CR–114992-Vol.2			
JAB–					
10733-TM10	18:33981	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018077	MF-703
10733-TM11	18:33982	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018079	MF-703
10733-TM7	18:33978	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018071	MF-703
10733-TM8	18:33979	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018073	MF-703
10733-TM9	18:33980	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018075	MF-703
JAERI-M–					
93-042	18:32627	OSTI; NTIS; INIS		DE93520240	
KAPL–					
4747	18:33412	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013220	PC-506

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
KCP–					
613-5111	18:33272	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040347	PC-706
613-5244	18:33734	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019773	PC-706
KEK–					
92-16	18:33478	OSTI; NTIS; INIS		DE93520380	
92-17	18:33597	OSTI; NTIS; INIS		DE93520300	
92-18	18:33598	OSTI; NTIS; INIS		DE93520301	
KEK-PR–					
92-1	18:33640	OSTI; NTIS; INIS		DE93520379	
92-2	18:33599	OSTI; NTIS; INIS		DE93520302	
KEK-PROC–					
92-5	18:33456	OSTI; NTIS; INIS		DE93520385	
92-12	18:33506	OSTI; NTIS; INIS		DE93520378	
92-13	18:33479	OSTI; NTIS; INIS		DE93520384	
92-16	18:34660	OSTI; NTIS; INIS		DE93520383	
KFKI–					
1992-26/G	18:32774	OSTI; NTIS (US Sales Only); INIS		DE94600262	
1992-27/G	18:32806	OSTI; NTIS (US Sales Only); INIS		DE94600250	
1992-28/B,G	18:34421	OSTI; NTIS (US Sales Only); INIS		DE94600426	
1992-29/D	18:34510	OSTI; NTIS (US Sales Only); INIS		DE94600527	
1992-30/A	18:34422	OSTI; NTIS (US Sales Only); INIS		DE94600427	
1992-31/A	18:34033	OSTI; NTIS (US Sales Only); INIS		DE94600366	
1992-33/G	18:32919	OSTI; NTIS (US Sales Only); INIS		DE94600263	
KURRI-TR–					
368	18:34484	OSTI; NTIS; INIS		DE93520314	
LA–					
12370-MS	18:33180	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019687	MF-706; MF-721
12387-M	18:32920	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018407	MF-714
12536-MS	18:33413	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018394	MF-361
12539-MS	18:33962	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019035	MF-902
12545-MS	18:34608	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018396	MF-904
12569	18:33273	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017437	MF-701
12571-C	18:33769	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93015865	MF-902
12588-PR	18:32630	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017619	MF-500
12592-MS	18:33129	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019095	MF-900
12593-M	18:32810	*See* NUREG/CR–6060			
12615-MS	18:33963	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019359	
12619-MS	18:33134	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018397	MF-900
12626-MS	18:32587	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018875	MF-906
12638-PR	18:32631	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019394	MF-500
LA-SUB–					
93-185	18:32415	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018276	MF-814
93-189	18:33678	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019301	MF-413
93-201	18:33714	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019297	
93-204	18:33735	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018271	MF-700
93-214	18:34661	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019300	MF-905
93-216	18:32786	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019303	
93-230	18:32921	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019302	MF-700
93-234	18:34609	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018272	MF-424
93-237-Vol.1	18:32755	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018280	MF-900
93-237-Vol.2	18:33114	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018281	MF-900
93-239	18:33119	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018283	MF-700
93-241	18:33374	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018279	MF-706; MF-741
93-242	18:32416	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019304	MF-940
93-245	18:32986	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019305	MF-900
93-246	18:33707	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93018284	
93-249	18:34628	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019294	MF-400
93-250	18:32344	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019306	MF-900
93-257	18:32417	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019299	MF-940
93-258	18:32418	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019298	MF-721
LA-UR–					
91-3572	18:33679	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018564	MF-906
93-1056	18:33414	OSTI; NTIS; GPO Dep.	E 1.99:	DE93011273	MF-940
93-1057	18:33415	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010731	MF-940
93-1058	18:33416	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010730	MF-940
93-1244	18:34662	OSTI; NTIS; GPO Dep.	E 1.99:	DE93012654	MF-905
93-1424	18:32721	OSTI; NTIS; GPO Dep.	E 1.99:	DE93012670	MF-252
93-1562	18:33990	OSTI; NTIS; GPO Dep.	E 1.99:	DE93012732	
93-1676	18:32922	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014424	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
93-1815	18:33770	OSTI; NTIS; GPO Dep.	E 1.99:	DE93014559	MF-741
93-1938	18:33375	OSTI; NTIS; GPO Dep.	E 1.99:	DE93014358	MF-705
93-2073	18:32722	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016627	
93-2151	18:32727	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016613	MF-251
93-2171	18:32419	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016606	MF-940
93-2183	18:32729	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016603	MF-251
93-2196	18:33337	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016601	MF-721
93-2214	18:33181	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018561	MF-904
93-2218	18:32588	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018560	MF-731
93-2261	18:32420	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018347	MF-940
93-2290	18:33182	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018345	MF-904
93-2291	18:33274	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018344	MF-904
93-2300	18:34423	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016467	MF-905
93-2301	18:34424	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016466	MF-905
93-2339	18:33183	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016456	MF-904
93-2345	18:33715	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018352	MF-741
93-2347	18:33716	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018350	MF-741
93-2348	18:33717	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018349	MF-741
93-2355	18:32633	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016489	MF-334
93-2372	18:33332	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018348	MF-701
93-2401	18:32965	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018357	MF-528
93-2429	18:34425	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016518	MF-700
93-2440	18:32421	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018356	MF-711
93-2450	18:33601	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018353	MF-910
93-2468	18:33424	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018362	MF-706
93-2486	18:34442	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018358	MF-910
93-2499	18:33184	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018375	MF-404; MF-904
93-2503	18:33376	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018374	MF-700
93-2515	18:33994	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018448	MF-706
93-2516	18:32565	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018372	MF-902; MF-906
93-2537	18:32781	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018371	MF-700
93-2538	18:32589	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018370	MF-1010
93-2541	18:33999	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018369	MF-702
93-2544	18:33693	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018367	MF-706
93-2547	18:33718	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018365	MF-741
93-2548	18:33719	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018364	MF-741
93-2550	18:33720	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018559	MF-741
93-2556	18:34467	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018556	MF-414
93-2568	18:32590	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018554	MF-905
93-2580	18:32591	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018551	MF-940; MF-906
93-2581	18:32592	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018550	MF-940
93-2582	18:34426	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018549	MF-910
93-2584	18:32422	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018548	MF-940
93-2585	18:34663	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018547	MF-700
93-2586	18:33135	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018546	MF-700
93-2603	18:32593	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018543	MF-700
93-2605	18:32423	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018542	MF-900
93-2608	18:32424	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018540	MF-940
93-2610	18:32594	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018538	MF-940
93-2611	18:33377	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018537	MF-906
93-2623	18:33438	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018478	MF-706
93-2624	18:32425	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018477	MF-940
93-2627	18:33480	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018476	MF-910
93-2636	18:32611	*See* SAND–93-1678C			
93-2639	18:32595	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018471	MF-940
93-2644	18:34056	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018470	MF-413
93-2652	18:34048	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018469	MF-413
93-2656	18:33417	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018468	MF-906
93-2659	18:34057	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018467	MF-414
93-2667	18:32596	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018465	MF-700
93-2668	18:32597	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017954	MF-900
93-2669	18:32598	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018464	MF-700
93-2675	18:33602	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018461	MF-706; MF-700
93-2690	18:33275	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018296	MF-904; MF-910
93-2692	18:34456	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018295	MF-904

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
93-2693	18:33231	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018294	MF-406; MF-404
93-2700	18:34611	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018293	MF-424
93-2706	18:32426	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018292	MF-902; MF-940
93-2739	18:33185	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018291	MF-404
93-2761	18:32427	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018290	MF-814
93-2764	18:33866	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018289	MF-908
93-2769	18:34511	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018288	MF-910
93-2799	18:33186	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018286	MF-704
93-2802	18:33425	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018285	
93-2921	18:33771	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019960	MF-902
93-2934	18:33814	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040098	MF-902
93-2935	18:33815	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040097	MF-902
93-3148	18:32599	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019973	MF-707
93-420	18:34610	OSTI; NTIS; GPO Dep.	E 1.99:	DE93007327	MF-700; MF-705
93-913	18:34635	OSTI; NTIS; GPO Dep.	E 1.99:	DE93010706	MF-900
LBL–					
26224	18:32471	*See* SAND–88-7054			
29166	18:32966	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019096	MF-403
29166-Rev.	18:32967	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019097	MF-403
32822-Rev.2	18:33043	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016706	MF-900
32837	18:33848	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019099	
32907	18:32730	OSTI; NTIS; GPO Dep.	E 1.99:	DE93015291	MF-251
32941	18:33022	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019098	
33190	18:33603	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018713	MF-410
33197	18:33604	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018700	MF-410
33220	18:33643	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018703	MF-410
33221	18:33605	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018705	MF-410
33223	18:33481	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018704	MF-410
33224	18:33606	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018535	MF-414
33240	18:33482	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018712	MF-410
33254	18:33607	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018709	MF-410
33265	18:33644	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018701	MF-414
33283	18:33608	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018536	MF-414
33284	18:34612	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018711	MF-419
33285	18:33507	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018533	MF-414
33286	18:33508	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018530	MF-414
33287	18:34613	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018698	MF-419
33289	18:34614	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018706	MF-410
33290	18:33609	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018708	MF-410
33291	18:33610	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018534	MF-414
33292	18:33611	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018699	MF-410
33294	18:33612	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018702	MF-410
33315	18:33613	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018707	MF-419
33377	18:33457	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019100	MF-410; MF-414; MF-415; MF-420
33441	18:33027	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018527	MF-350
33442	18:33772	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018601	MF-350
33444	18:32971	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018602	MF-350
33445	18:33773	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019101	MF-402
33532	18:33849	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016714	
33804	18:34615	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019242	MF-419
33984	18:33816	OSTI; NTIS; GPO Dep.	E 1.99:	DE93015037	MF-403
34030	18:33232	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016978	MF-404
34072	18:33509	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018710	MF-410
34076	18:33850	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018597	
34091	18:33694	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018595	MF-401
34174	18:33044	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019102	MF-900
34189	18:33233	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018598	MF-404
34239	18:33483	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018526	MF-413
34240	18:34000	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018525	MF-414
34241	18:34049	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018528	MF-413
34250	18:32179	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019103	MF-109
34251	18:33339	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019252	MF-401
34277	18:34410	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018529	MF-413
34291	18:33187	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018594	MF-404
34297	18:33774	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019246	MF-401

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
34308	18:32180	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019251	MF-105
34313	18:34058	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019230	MF-414
34362	18:33088	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019226	MF-350
34372	18:34050	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018524	MF-414
34386	18:32972	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040303	MF-213
91-Rev.	18:34021	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040296	MF-414
LBL-PUB–					
725	18:34629	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019265	MF-400
727	18:32987	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018596	MF-400
728	18:33983	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018532	MF-403
729	18:33031	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018531	MF-400
LITH-MAT-R–					
93-05	18:34028	OSTI; NTIS; INIS		DE94600360	
93-10	18:34664	OSTI; NTIS; INIS		DE94600343	
LIU-TEK-LIC–					
1992-49	18:33340	OSTI; NTIS; INIS		DE94600056	
1993-09	18:33418	OSTI; NTIS; INIS		DE94600234	
1993-11	18:34468	OSTI; NTIS; INIS		DE94600534	
LIU-TEMA-T-R–					
31	18:32988	OSTI; NTIS; INIS		DE93516739	
LIU-TEMA-V-R–					
18	18:32988	*See* LIU-TEMA-T-R–31			
LLNL–					
1A1503	18:33868	*See* UCRL-CR–114236			
LSGN–					
103	18:33604	*See* LBL–33197			
105	18:33603	*See* LBL–33190			
123	18:33611	*See* LBL–33292			
128	18:33612	*See* LBL–33294			
LUND-MPH–					
93-02	18:33991	OSTI; NTIS; INIS		DE94600353	
LUNFD6-NFFK–					
1006	18:34236	OSTI; NTIS; INIS		DE94600403	
LUNFD6-TFME–					
1025-1-14-1993	18:34034	OSTI; NTIS; INIS		DE94600364	
LUTEDX-TEIE–					
5069-1-49	18:33115	OSTI; NTIS		DE93516734	
5070-1-106	18:33123	OSTI; NTIS		DE93516735	
5074-1-86	18:32956	OSTI; NTIS		DE93516736	
5077-1-42	18:32957	OSTI; NTIS		DE93516737	
LUTVDG-TVTG–					
3034	18:32720	*See* NUTEK-GT–93-2			
MAO-PR–					
92-01	18:33188	OSTI; NTIS		DE93017272	
MDC–					
92E0008	18:34588	*See* DOE/ER/54101–T1-Vol.1			
92E0008	18:34589	*See* DOE/ER/54101–T1-Vol.2			
92E0008	18:34590	*See* DOE/ER/54101–T1-Vol.3			
MHD-ITC–					
92-236	18:33052	*See* DOE/PC/90274–T21			
93-017	18:33054	*See* DOE/PC/90274–T23			
93-040	18:33053	*See* DOE/PC/90274–T22			
MPR–					
1346	18:32939	*See* NUREG/IA–0127			
N–					
6-93-R109	18:33416	*See* LA-UR–93-1058			
6-93-R113	18:33414	*See* LA-UR–93-1056			
6-93-R114	18:33415	*See* LA-UR–93-1057			
NEDO-P–					
9212	18:33056	OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan		DE93520882	
9213	18:32673	OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan		DE93520883	
9229	18:33045	OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan		DE93520885	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
9231	18:33028	OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan		DE93520884	
9253	18:33029	OSTI; NTIS; Available from New Energy and Industrial Technology Development Organization, Sunshine 60, 30F 1-1, 3-chome, Higashi-Ikebukuro, Toshima-ku, Tokyo, Japan		DE93520886	
NEI-DK–					
1233	18:32711	OSTI; NTIS		DE93516638	
1234	18:33108	OSTI; NTIS		DE93516636	
1235	18:32243	OSTI; NTIS		DE93516632	
1240	18:32324	OSTI; NTIS; INIS		DE93516643	
1242	18:33023	OSTI; NTIS		DE93516646	
1243	18:33024	OSTI; NTIS		DE93516738	
1246	18:33120	OSTI; NTIS		DE93516648	
1257	18:33021	OSTI; NTIS		DE93516673	
1258	18:33089	OSTI; NTIS		DE93516672	
1261	18:32981	OSTI; NTIS		DE93525256	
1262	18:33090	OSTI; NTIS		DE93525252	
1263	18:32719	OSTI; NTIS		DE93525255	
1264	18:33775	OSTI; NTIS		DE93525254	
1265	18:33042	OSTI; NTIS		DE93525251	
1266	18:32712	OSTI; NTIS		DE93525253	
1267-Ed.2	18:32989	OSTI; NTIS		DE93525249	
1268	18:32667	OSTI; NTIS		DE93525265	
1269	18:33109	OSTI; NTIS		DE93525267	
1270	18:33032	OSTI; NTIS		DE93525262	
1271	18:33049	OSTI; NTIS		DE93525261	
NEI-NO–					
346	18:32253	OSTI; NTIS		DE93525282	
347	18:32990	OSTI; NTIS		DE93516701	
348	18:32991	OSTI; NTIS		DE93516702	
349	18:34665	OSTI; NTIS		DE93516703	
350	18:32325	OSTI; NTIS		DE93516704	
351	18:32273	OSTI; NTIS		DE93516705	
352	18:32274	OSTI; NTIS		DE93516706	
353	18:33121	OSTI; NTIS		DE93516707	
354	18:33110	OSTI; NTIS		DE93516708	
355	18:32289	OSTI; NTIS; INIS		DE93525287	
356	18:33435	OSTI; NTIS		DE93525288	
357	18:34666	OSTI; NTIS		DE93525289	
358	18:33776	OSTI; NTIS		DE93525291	
359	18:32713	OSTI; NTIS		DE93525292	
360	18:33000	OSTI; NTIS; INIS		DE93525293	
NEI-SE–					
118	18:32428	OSTI; NTIS; INIS		DE94600313	
NIFS–					
205	18:34512	OSTI; NTIS; INIS		DE93520241	
NIPER–					
606	18:32302	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93000153	PC-122
622	18:32254	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000155	PC-122
669	18:32275	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000154	PC-122
683	18:32276	OSTI; NTIS; GPO Dep.	E 1.99:	DE93000156	PC-122
684-Vol.1	18:32312	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019925	MF-125
700-Vol.1	18:32313	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019926	MF-125
706	18:32277	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019955	MF-122; MF-125
NKS–					
93-1	18:32923	OSTI; NTIS; INIS		DE94600189	
93-2	18:32924	OSTI; NTIS; INIS		DE94600190	
NPRW-CON–					
90-1	18:32942	*See* SAND–90-0119			
91-3	18:32898	*See* SAND–92-2593			
NREL/TP–					
411-5654	18:32685	OSTI; NTIS; GPO Dep.	E 1.99:	DE93010046	MF-271
421-5264	18:33101	OSTI; NTIS; GPO Dep.	E 1.99:	DE93010047	MF-335
421-5462	18:33126	OSTI; NTIS; GPO Dep.	E 1.99:	DE93010035	MF-335
442-5617	18:32745	OSTI; NTIS; GPO Dep.	E 1.99:	DE93010041	MF-261
451-5354	18:32686	OSTI; NTIS; GPO Dep.	E 1.99:	DE93010049	MF-272
451-5651	18:32687	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017117	MF-271

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NREL/TP–					
451-5652	18:32688	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018201	MF-273
472-5539	18:32695	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018208	MF-270
NUREG–					
0525-Vol.2-Rev.1	18:32600	OSTI; NTIS; INIS; GPO		TI93018114	
0540-Vol.15-No.5	18:32789	OSTI; NTIS; INIS; GPO		TI93017982	
0750-Vol.36-Index-2	18:32790	OSTI; NTIS; INIS; GPO		TI93016258	
0750-Vol.37-Index-1	18:32791	OSTI; NTIS; INIS; GPO		TI93018175	
0750-Vol.37-No.4	18:32792	OSTI; INIS; GPO; NTIS		TI93017823	
0750-Vol.37-No.5	18:33020	OSTI; NTIS; INIS; GPO		TI93018939	
0936-Vol.12-No.2	18:32793	OSTI; NTIS; INIS; GPO		TI93018869	
1461	18:32794	OSTI; NTIS; INIS; GPO		TI93019499	
1463	18:32925	OSTI; NTIS; INIS; GPO		TI93018868	
NUREG/CP–					
0130-Vol.1	18:32820	OSTI; NTIS; INIS; GPO		TI93017886	MF-902
0130-Vol.2	18:32821	OSTI; NTIS; INIS; GPO		TI93017887	MF-902
NUREG/CR–					
3469-Vol.7	18:32926	OSTI; INIS; NTIS; GPO		TI93018131	
4744-Vol.7-No.2	18:32807	OSTI; NTIS; INIS; GPO		TI93018014	
5404-Vol.2	18:32808	OSTI; NTIS; INIS; GPO		TI93018395	
5758-Vol.3	18:32927	OSTI; NTIS; INIS; GPO		TI93019180	
5817-Vol.3-No.2	18:32459	OSTI; NTIS; INIS; GPO		TI93040026	
5833	18:32928	OSTI; NTIS; INIS; GPO		TI93019036	
6021	18:32460	OSTI; NTIS; INIS; GPO		TI93019109	
6023	18:32929	OSTI; NTIS; INIS; GPO		TI93017824	
6029-Vol.1	18:32809	OSTI; NTIS; INIS; GPO		TI93040399	
6049	18:32930	OSTI; NTIS; INIS; GPO		TI93019500	
6052	18:32931	OSTI; NTIS; INIS; GPO		TI93019396	
6058	18:32822	OSTI; NTIS; GPO		TI93017989	
6060	18:32810	OSTI; NTIS; INIS; GPO		TI93017872	
6065	18:32779	OSTI; NTIS; INIS; GPO		TI93018253	
6079	18:32932	OSTI; NTIS; INIS; GPO		TI93019679	
6082	18:32933	OSTI; NTIS; INIS; GPO		TI93019928	
6083	18:32934	OSTI; NTIS; INIS; GPO		TI93019915	
NUREG/GR–					
0005-Vol.2-Pt.1	18:32771	OSTI; NTIS; INIS; GPO		TI93019179	
NUREG/IA–					
0085	18:32935	OSTI; NTIS; INIS; GPO		TI93018820	
0091	18:32936	OSTI; NTIS (documentation only); ESTSC (complete software package), P.O. Box 1020, Oak Ridge, TN 37831-1020; GPO; INIS		TI93019027	
0103	18:32937	OSTI; NTIS; INIS; GPO		TI93017983	
0112	18:32938	OSTI; NTIS; INIS; GPO		TI93018130	
0127	18:32939	OSTI; NTIS; INIS; GPO		TI93018782	
NUTEK-FBT–					
93-5	18:33189	OSTI; NTIS		DE93795066	
NUTEK-GT–					
93-2	18:32720	OSTI; NTIS		DE93795068	
NUTEK-VK–					
93-4	18:33777	OSTI; NTIS		DE93795070	
NWPO-TR–					
016-91	18:32461	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018771	MF-814
NYSERDA–					
93-6	18:33091	OSTI; New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, NY 12223		TI93018136	
93-8	18:33046	OSTI; New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, NY 12223		TI93018133	
93-10	18:33127	OSTI; New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, NY 12223		TI93018135	
93018728	18:32462	OSTI; New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, NY 12223		TI93018728	
OCDO–					
93017598	18:32767	OSTI; Ohio Coal Development Office, 77 S. High Street, P.O. Box 1001, Columbus, OH 43266-0001 (United States)		TI93017598	
93017599	18:32768	OSTI; Ohio Coal Development Office, 77 S. High Street, P.O. Box 1001, Columbus, OH 43266-0001 (United States)		TI93017599	

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93017600	18:32244	OSTI; Ohio Coal Development Office, 77 S. High Street, P.O. Box 1001, Columbus, OH 43266-0001 (United States)		TI93017600	
ORNL–					
6566/V1	18:32808	*See* NUREG/CR–5404-Vol.2			
6741	18:33287	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017953	MF-400
6749	18:33305	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017938	PC-401
6750	18:33062	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019691	MF-400
6760	18:33141	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017674	MF-404
ORNL/ATD–					
75	18:33012	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017381	MF-332
ORNL/CDIAC–					
62	18:34702	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017675	MF-402
ORNL/CON–					
326	18:33025	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018884	MF-350
359	18:33102	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018727	MF-361
367	18:33092	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018129	MF-350
368	18:33026	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017936	PC-310
ORNL/CSD/FTR–					
4289	18:33378	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014309	MF-523
ORNL/ENG/TM–					
41	18:32714	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018046	
ORNL/ER–					
157-D3	18:32547	*See* DOE/OR–01-1122-D3			
ORNL/ER/Sub–					
87-99053/3/R1	18:32566	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016367	MF-902
90-LJ068/1-D1	18:32549	*See* DOE/OR–01-1168-D1			
ORNL/FTR–					
3948	18:33680	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93016414	MF-406
4003	18:33234	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93016413	MF-406
4203	18:33614	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014400	MF-413
4326	18:32777	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014308	MF-522
4345	18:33948	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014401	MF-407
4582	18:34492	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93013712	MF-404
4586	18:33013	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015466	MF-400
4600	18:33190	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015470	
4602	18:34427	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014360	MF-405
4604	18:34428	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014638	MF-413
4607	18:32778	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014748	MF-522
4611	18:32567	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014660	MF-902
4616	18:33379	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014663	MF-406
4620	18:34703	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014862	MF-400
4627	18:33964	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015638	MF-402
4630	18:34616	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015639	MF-423
4631	18:32601	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015640	MF-700
4632	18:33681	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019175	MF-413
4635	18:32345	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015467	MF-610
4636	18:32346	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015468	
4642	18:33949	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93015789	MF-407
4644	18:33380	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017060	MF-406
4645	18:34469	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93016209	MF-700
4654	18:33191	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017237	
4655	18:32347	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017236	MF-940
4657	18:33306	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93016771	MF-401
4661	18:34152	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017061	MF-413
4691	18:33307	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93018863	MF-401
ORNL/GWPO–					
003	18:33818	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019601	MF-902
ORNL/M–					
1178	18:33034	OSTI; NTIS; GPO Dep.	E 1.99:	DE93041180	MF-600
1897	18:32616	OSTI; NTIS; GPO Dep.	E 1.99:	DE93007312	MF-630
1899	18:33001	OSTI; NTIS; GPO Dep.	E 1.99:	DE93041181	MF-600
1900	18:33035	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93008331	MF-630
2810	18:32382	*See* DOE/OR–03-1150-D1			
2881	18:33235	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018277	MF-332
2936	18:33778	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018881	MF-402
2965	18:32378	*See* DOE/MWIP–9			
2966	18:32379	*See* DOE/MWIP–10			
483	18:33033	OSTI; NTIS; GPO Dep.	E 1.99:	DE93041213	MF-630
ORNL/NERP–					
8	18:33819	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040333	MF-902

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
ORNL/Sub–					
90-SB047/2	18:33236	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018128	MF-332
93-SD684	18:32931	*See* NUREG/CR–6052			
ORNL/TM–					
10071/R3	18:32795	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017937	PC-520
12102	18:33682	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019735	MF-407
12181	18:33381	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019224	MF-406
12215	18:32940	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019222	MF-406
12217	18:33820	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019361	MF-902
12223	18:34470	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019104	MF-411
12224	18:33950	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040067	MF-507
12225	18:33821	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017987	MF-902
12235	18:33851	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017955	MF-903
12252	18:34667	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019163	MF-405; MF-000
12260	18:33822	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019397	MF-902
12286	18:33333	OSTI; NTIS; GPO Dep.	E 1.99:	DE93013458	
12300	18:33683	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019856	MF-407
12317	18:33823	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017850	MF-903
12318	18:34668	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018278	MF-405
12322	18:33334	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017384	MF-413
12340	18:32929	*See* NUREG/CR–6023			
12341	18:33192	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017988	MF-103; MF-109; MF-114
12344	18:32782	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017935	PC-530
12347	18:34669	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018805	MF-405
12365	18:33951	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017986	MF-607
12384	18:32968	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018882	MF-202
12388	18:34670	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019223	MF-405
12396	18:32779	*See* NUREG/CR–6065			
12408	18:34671	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018381	MF-705
12409	18:33779	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019818	MF-502
12410	18:33382	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019221	MF-405
12411	18:33867	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018493	MF-408
12446	18:33383	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019205	MF-406
OUP–					
93-09	18:34029	OSTI; NTIS; INIS		DE94600359	
PATENTS-					
	18:32278	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			
	18:32279	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			
	18:32280	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			
	18:32281	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			
	18:32282	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			
	18:32283	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			
	18:32284	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			
	18:32285	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
	18:32286	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			
	18:32287	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			
	18:32288	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			
	18:32290	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			
	18:32291	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			
	18:32292	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			
	18:32305	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			
	18:32308	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			
	18:32318	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			
	18:32323	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			
	18:32668	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			
	18:32716	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			
	18:32756	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			
	18:32959	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			
	18:32974	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			
	18:32975	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			
	18:33060	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			
	18:33284	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
	18:33407	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			
	18:33431	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			
	18:33432	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			
	18:33433	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			
	18:33434	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2 PC $6.00 CAN; MF $4.00 CAN			
PATENTS-US-					
A7728477	18:34493	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019340	MF-404
A7739376	18:33426	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019338	MF-704
A7744746	18:32348	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019336	MF-523
A7744747	18:33341	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019335	MF-701
A7744752	18:32245	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019334	MF-104
A7746537	18:32602	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019332	MF-406
A7748585	18:33237	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019330	MF-904
A7750681	18:33276	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019327	MF-706
A7751002	18:34672	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019326	MF-705
A7751003	18:33335	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019325	MF-706
A7751900	18:32568	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019323	MF-702; MF-721
A7754839	18:33384	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019322	MF-706
A7754840	18:33308	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019321	MF-700
PFC/RR-					
93-3	18:34501	*See* DOE/ET/51013-T248			
PNL-					
7907	18:32928	*See* NUREG/CR-5833			
8391	18:32463	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016710	MF-902
8477	18:32569	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040111	MF-510
8525	18:32464	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017942	MF-602
8594-Vol.1	18:32809	*See* NUREG/CR-6029-Vol.1			
8613-Pt.1	18:33967	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019172	MF-500
8613-Pt.2	18:33968	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019115	MF-500
8645	18:33645	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017970	
8662	18:33824	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016708	MF-903
8676	18:33825	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017231	MF-900
8688-Vol.3	18:32927	*See* NUREG/CR-5758-Vol.3			
8717	18:32969	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019106	MF-202
8725	18:33093	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040200	MF-350
8730-Vol.3	18:33094	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017941	MF-350
8739	18:33111	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018494	MF-311
8744	18:33780	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018495	MF-603
8745	18:32465	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019981	MF-902
8748	18:33385	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018379	MF-500
8749	18:33952	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018452	MF-900
8756-Vol.2	18:33095	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040348	MF-350
8766	18:33852	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019600	
8770	18:33002	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019184	MF-900
8771-Vol.2	18:33096	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019881	MF-350
PNL-MA-					
599-Vol.1	18:34636	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019189	MF-507
599-Vol.2	18:33309	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019190	MF-507
599-Vol.3	18:33310	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019191	MF-507
599-Vol.4	18:33311	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019192	MF-507
599-Vol.5	18:33312	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019193	MF-507
599-Vol.6	18:33313	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019194	MF-507
599-Vol.7	18:33314	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019195	MF-507
PNL-SA-					
21173	18:33419	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017979	MF-506

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
21235	18:33193	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017671	MF-423
21495	18:32570	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017606	MF-513
21514	18:32466	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018788	MF-721
21625	18:33826	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017218	MF-502
21741	18:33953	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019171	MF-408
21767	18:33386	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018794	MF-402
21780	18:32896	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018002	MF-520
21788	18:32941	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017662	MF-523
21852	18:33439	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018795	
21926	18:33615	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017663	MF-413
21961	18:34471	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019170	MF-506
22024	18:33684	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017664	MF-406
22041	18:33387	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018451	MF-900
22046	18:32571	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93010170	MF-902
22090	18:32735	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018182	MF-261
22129	18:32603	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018873	MF-700
22130	18:32604	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018874	MF-700
22358	18:34704	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018785	MF-900
22371	18:34637	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018787	MF-500
22609	18:32964	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018793	MF-261
22611	18:32982	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017669	MF-900
22658	18:33781	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017670	MF-902
22730	18:33277	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018450	MF-404
22777	18:33278	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018784	MF-704
PNWD–					
2161-HEDR	18:33954	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017969	
POEF–					
3039	18:32467	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019688	MF-507
PPL–					
2923	18:33782	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017516	PC-427
PPPL–					
2912	18:34617	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018389	PC-421; PC-427
2925	18:34513	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017518	PC-420; PC-426
PRRC–					
92-45	18:32272	*See* DOE/MC/26031–3442			
RFP–					
4717	18:32572	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93015413	MF-607
4719	18:33388	OSTI; NTIS; GPO Dep.	E 1.99:	DE93015416	MF-600
4720	18:32573	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93015409	MF-600; MF-607
4725	18:32574	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018798	MF-700
4729	18:33003	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018801	MF-610
4730	18:32468	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018803	MF-721
4739	18:33194	OSTI; NTIS; GPO Dep.	E 1.99:	DE93012701	MF-704
RISO-HOT-DECOM-P–					
5	18:33955	OSTI; NTIS; INIS		DE94600192	
RISO-R–					
682(EN)	18:34638	OSTI; NTIS; INIS		DE94600346	
691(EN)	18:32746	OSTI; NTIS; Also available from Risoe Library, P.O. Box 49, DK-4000 Roskilde, Denmark		DE93516675	
RISOe-R–					
703(EN)	18:32326	OSTI; NTIS; Also available from Risoe Library, P.O. Box 49, DK-4000 Roskilde, Denmark		DE93525257	
RL-SEP–					
180	18:32332	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017366	MF-711
655	18:32342	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017473	MF-500
RT/AMB–					
92-02	18:32411	*See* ENEA-RT-AMB–92-02			
92-05	18:32671	*See* ENEA-RT-AMB–92-05			
92-10	18:32672	*See* ENEA-RT-AMB–92-10			
RT/DISP–					
91-04	18:33372	*See* ENEA-RT-DISP–91-04			
RT/ENERG–					
91-07	18:34650	*See* ENEA-RT-ENERG–91-07			
RT/INN–					
91-02	18:32684	*See* ENEA-RT-INN–91-02			
92-16	18:34601	*See* ENEA-RT-INN–92-16			
92-22	18:33258	*See* ENEA-RT-INN–92-22			
92-29	18:33436	*See* ENEA-RT-INN–92-29			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
92-34	18:34701	*See* ENEA-RT-INN–92-34			
92-36	18:33295	*See* ENEA-RT-INN–92-36			
92-41	18:33809	*See* ENEA-RT-INN–92-41			
RT/NUCL–					
91-09	18:33410	*See* ENEA-RT-NUCL–91-09			
92-01	18:33767	*See* ENEA-RT-NUCL–92-01			
RTI-INN–					
92-16	18:34505	*See* ENEA-RTI-INN–92-16			
RTI/STUDI-ENE–					
92-04	18:33122	*See* ENEA-RTI-STUDI-ENE–92-04			
SAND–					
86-7168	18:32469	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018677	MF-721
88-1314	18:32470	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018516	MF-721
88-7054	18:32471	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018768	MF-814
90-0119	18:32942	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93018678	MF-940; MF-1006
90-3074C	18:32472	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013763	MF-940
91-0047-Vol.3	18:32473	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018437	MF-721
91-0252	18:32943	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017943	MF-743
91-1144	18:34001	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018519	MF-405
91-1269	18:33736	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018520	MF-706
92-0229	18:33315	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018521	MF-501
92-0450	18:32474	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018522	MF-814
92-0535C	18:33142	OSTI; NTIS; GPO Dep.	E 1.99:	DE93009842	MF-704
92-0960	18:32475	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018523	MF-814
92-0966	18:33389	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018676	MF-940
92-0967	18:33390	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018916	MF-940
92-1094	18:32897	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018515	MF-704
92-1381	18:32717	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018509	MF-235
92-1827	18:32944	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93040202	MF-1007
92-1832	18:33238	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019927	MF-704
92-1864	18:33391	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018510	MF-704
92-2035-Vol.1-Chg.1	18:32575	OSTI; NTIS; GPO Dep.	E 1.99:	DE93014109	MF-900
92-2035-Vol.2-Chg.1	18:32576	OSTI; NTIS; GPO Dep.	E 1.99:	DE93014300	MF-900
92-2131	18:32715	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040203	MF-237
92-2253	18:32718	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018512	MF-233
92-2268C	18:33392	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017500	MF-706
92-2283	18:32310	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019308	MF-126
92-2324	18:33393	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019107	MF-940
92-2334	18:32476	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018679	MF-814
92-2347C	18:32697	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017649	ND-236
92-2395	18:33014	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE93017676	PC-900
92-2397	18:33708	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018680	MF-705
92-2401	18:33394	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018513	MF-722
92-2431	18:32477	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018681	MF-814
92-2487C	18:33279	OSTI; NTIS; GPO Dep.	E 1.99:	DE93011596	MF-706
92-2521	18:34673	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018514	MF-900
92-2593	18:32898	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93018688	MF-940; MF-1006
92-2762	18:32478	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018682	MF-814
92-2801C	18:33103	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017889	MF-900
92-2844	18:33701	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018503	MF-704
92-2863	18:32945	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018504	
92-7007	18:32689	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018505	MF-275
92-7291	18:32479	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018502	MF-721
92-7340	18:32480	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018684	MF-721
93-0051	18:32605	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019772	MF-706
93-0135C	18:32349	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017892	
93-0145C	18:33440	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017652	MF-906
93-0183C	18:33015	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018845	MF-706; MF-721
93-0186C	18:33420	OSTI; NTIS; GPO Dep.	E 1.99:	DE93011592	MF-706
93-0242C	18:33395	OSTI; NTIS; GPO Dep.	E 1.99:	DE93008348	MF-705; MF-706
93-0256	18:33984	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018686	MF-403
93-0332C	18:33709	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017654	MF-706
93-0388C	18:33239	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018833	MF-700
93-0389C	18:33710	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018832	MF-706

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
93-0390C	18:33195	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017506	MF-700
93-0391C	18:32747	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018861	MF-261
93-0402C	18:33747	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018835	MF-700
93-0418C	18:33427	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017873	MF-700
93-0421C	18:32181	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017487	MF-108
93-0425C	18:34514	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017625	MF-706
93-0427C	18:33196	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017877	MF-404
93-0445C	18:32606	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017495	MF-706
93-0457C	18:34002	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018834	MF-701; MF-704
93-0470C	18:32607	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017489	MF-706
93-0529	18:32787	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018440	
93-0541C	18:33280	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017496	MF-704
93-0559C	18:33396	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017895	ND-706
93-0587	18:34674	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018687	MF-905
93-0644	18:33695	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017944	MF-706
93-0700	18:32992	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018442	MF-900
93-0704	18:33737	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018047	MF-705
93-0729	18:32481	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019211	MF-721
93-0743C	18:33281	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018839	MF-704
93-0761C	18:33956	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93015023	MF-907
93-0763	18:33197	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018689	MF-704
93-0771C	18:32608	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017648	MF-700
93-0830	18:33397	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018690	MF-722
93-0875C	18:33986	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019409	MF-705
93-0882C	18:33702	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017874	MF-700
93-0916C	18:34003	OSTI; NTIS; GPO Dep.	E 1.99:	DE93012849	MF-706
93-0917C	18:34675	OSTI; NTIS; GPO Dep.	E 1.99:	DE93015024	MF-705
93-0934C	18:34676	OSTI; NTIS; GPO Dep.	E 1.99:	DE93012840	MF-705
93-0935C	18:34677	OSTI; NTIS; GPO Dep.	E 1.99:	DE93012841	MF-705
93-0936C	18:34678	OSTI; NTIS; GPO Dep.	E 1.99:	DE93012844	MF-705
93-0940	18:34679	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040206	MF-705
93-0941	18:34680	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040207	MF-705
93-0947	18:33131	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018691	MF-700
93-1006C	18:33441	OSTI; NTIS; GPO Dep.	E 1.99:	DE93012856	MF-706
93-1044	18:33783	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018692	MF-702
93-1055	18:32482	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040210	MF-940
93-1063C	18:33442	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016730	MF-704
93-1083C	18:32973	OSTI; NTIS; GPO Dep.	E 1.99:	DE93015130	MF-700
93-1135C	18:32483	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013757	MF-721
93-1180C	18:32311	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016867	MF-704
93-1206	18:33198	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018693	MF-705
93-1232	18:33703	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019309	MF-906
93-1263C	18:32788	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017492	
93-1333C	18:32182	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017632	MF-102; MF-108
93-1347C	18:33136	OSTI; NTIS; GPO Dep.	E 1.99:	DE93014997	MF-900
93-1348C	18:32484	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017494	MF-902
93-1355C	18:34681	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017647	MF-705
93-1373	18:34682	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018694	MF-405
93-1388	18:34004	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018903	MF-705
93-1389	18:34005	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018904	MF-705
93-1393C	18:34683	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016869	MF-705
93-1395C	18:34457	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017638	MF-704
93-1403C	18:32577	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017490	MF-906
93-1414C	18:33443	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017634	MF-704
93-1415C	18:32485	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017656	MF-814
93-1444C	18:34639	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016497	MF-705
93-1455C	18:33199	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017629	MF-704
93-1474C	18:33444	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018837	MF-706
93-1481C	18:32899	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017493	MF-1000
93-1486C	18:33484	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017627	MF-1000
93-1495C	18:33398	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017640	MF-706
93-1510C	18:32609	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017650	MF-700
93-1554C	18:33336	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017501	MF-401
93-1597C	18:33445	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017651	ND-706
93-1598C	18:33446	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017635	MF-706
93-1633C	18:33137	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017503	MF-706
93-1661C	18:33282	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019064	MF-704

SAND–

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
93-1667C	18:33138	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018855	MF-700
93-1669C	18:32610	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018854	MF-700
93-1672	18:33112	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019580	PC-900
93-1674C	18:33711	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017502	
93-1678C	18:32611	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017876	MF-700
93-1693C	18:32612	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017890	MF-700
93-1696	18:33744	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040212	MF-706
93-1699C	18:32613	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017893	MF-700
93-1701C	18:34705	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017880	MF-705
93-1714C	18:33139	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017891	MF-906
93-1721C	18:34706	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017875	MF-705
93-1773C	18:33447	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017894	ND-706
93-7000	18:32698	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018443	MF-234
93-7019	18:32486	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018444	MF-940
93-7027	18:32811	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018695	MF-523
93-7028	18:32725	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018445	MF-252
93-7029	18:32726	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018446	MF-252
93-7031	18:33784	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018454	MF-234
93-7042	18:32317	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018488	
93-7049	18:32690	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018489	MF-274
93-7051	18:32691	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018490	MF-274
93-7055	18:32692	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018491	MF-274
93-8011	18:33785	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018697	MF-402
93-8233	18:33859	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017898	MF-408
93-8236	18:32246	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017283	MF-104
SEO–					
301	18:32979	*See* ECN-C–93-030			
SIS–					
1993:2	18:33957	OSTI; NTIS; INIS		DE94600194	
1993:3	18:33958	OSTI; NTIS; INIS		DE94600195	
SKI-TR–					
93-17	18:32815	OSTI; NTIS; INIS		DE94600255	
SLAC-TN–					
93-3	18:33485	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017931	MF-414
SOL–					
93-4	18:34684	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019404	MF-405
93-5	18:34685	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019401	MF-405
SP–					
93-13	18:33200	OSTI; NTIS; INIS		DE94600069	
SR/H–					
592	18:32350	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93016189	MF-721
603	18:33733	*See* DPST–62-200-Vol.3			
613	18:32487	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019315	MF-700
615	18:32488	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93019313	MF-721
617	18:32407	*See* DPST–75-487			
618	18:32406	*See* DPE–3481			
SSCL–					
578-Rev.1	18:33510	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018649	PC-414
624	18:33486	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018651	PC-414
626	18:33511	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018912	PC-414
628	18:34686	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018008	MF-400
631	18:33512	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018913	PC-414
SSCL-Preprint–					
247	18:33616	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014170	MF-414
283	18:33617	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018748	MF-414
303	18:33618	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018009	MF-414
307	18:33619	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018006	MF-400
310	18:33487	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016893	MF-414
316	18:33620	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016887	MF-414
317	18:33621	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016892	MF-414
331	18:33458	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018013	MF-414
335	18:33622	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019824	MF-414
336	18:33623	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018007	MF-414
387	18:33624	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014101	MF-414
403	18:33513	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019119	MF-414
419	18:33625	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018011	MF-414
449	18:33626	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018004	MF-414
474	18:33514	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018758	MF-414
475	18:33627	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018759	MF-414
478	18:33628	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018012	MF-414
487	18:33629	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019741	MF-414

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SSCL-SR–					
1223	18:33630	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018650	PC-414
SSI–					
93-06	18:33853	OSTI; NTIS; INIS		DE94600125	
93-08	18:34640	OSTI; NTIS; INIS		DE94600347	
SUPRI-TR–					
91	18:32257	*See* DOE/BC/14600–51			
TES–					
32115-194	18:33055	*See* DOE/NE/32115–T1			
TR–					
4484-009-93	18:32232	*See* DOE/PC/89804–5			
TRI-PP–					
90-71	18:34051	OSTI; NTIS (US Sales Only); INIS		DE94600374	
90-72	18:33685	OSTI; NTIS (US Sales Only); INIS		DE94600286	
90-75.	18:33685	*See* TRI-PP–90-72			
TRITA-ALF–					
92-07	18:34515	OSTI; NTIS; INIS		DE94600437	
92-08	18:34516	OSTI; NTIS; INIS		DE94600464	
92-09	18:34517	OSTI; NTIS; INIS		DE94600465	
92-10	18:34518	OSTI; NTIS; INIS		DE94600466	
92-11	18:34519	OSTI; NTIS; INIS		DE94600435	
TTC–					
1209	18:33389	*See* SAND–92-0966			
1210	18:33390	*See* SAND–92-0967			
1236	18:33393	*See* SAND–92-2324			
1239	18:33394	*See* SAND–92-2401			
1258	18:33397	*See* SAND–93-0830			
UCB-PTH–					
93/21	18:34000	*See* LBL–34240			
UCRL–					
53689-92	18:33016	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018392	PC-700
53809-92	18:34006	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019209	PC-700
53868-92	18:33017	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016334	PC-706
93018172	18:34007	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018172	MF-705
UCRL-CR–					
103699	18:33448	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019501	MF-704
105418	18:33344	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019383	MF-900
112526	18:33201	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019914	MF-905
112568	18:33399	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017996	MF-706
112610	18:34618	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019626	MF-706
113452	18:34443	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017995	MF-517
113692	18:33721	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019609	
113693	18:33421	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019608	
113821	18:32333	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018001	MF-517
114236	18:33868	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019116	MF-700; MF-708
114509	18:33722	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019633	MF-722
114810	18:33345	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019631	MF-900
114992-Vol.2	18:33283	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040310	MF-906
UCRL-ID–					
104740	18:33827	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016951	MF-903
110618	18:33786	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019551	MF-702; MF-721
112216	18:33995	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019213	MF-900
112283	18:32489	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018496	MF-701
112284	18:32490	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018905	MF-900
112943	18:32327	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017960	MF-705; MF-706
113266	18:34619	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017945	MF-712
113275	18:33723	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018497	MF-701
113360	18:33724	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017961	MF-900
113364	18:33725	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017962	MF-900
113383	18:32491	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019212	MF-804
113516	18:33985	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018906	MF-702
113563	18:33726	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93014363	MF-741
113649	18:33132	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017964	MF-700
113660	18:33746	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017946	MF-700
113713	18:33696	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018907	MF-700
113760	18:33869	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018908	MF-900
113761	18:33787	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017948	MF-900
113763	18:33712	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017949	MF-900

UCRL-ID–

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
113780	18:33745	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019583	MF-700
113953-Rev.1	18:33698	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019880	MF-700
113954	18:33116	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018498	MF-906
114054	18:33788	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018499	MF-702
114259	18:34687	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019554	MF-900
114503	18:32993	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018909	MF-500
114533	18:33400	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018910	MF-700
114560	18:34008	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019584	MF-904
114565	18:32934	*See* NUREG/CR–6083			
114567	18:32933	*See* NUREG/CR–6082			
114802	18:33870	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018911	MF-908
114809	18:33738	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019555	MF-700
114953	18:34630	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019619	MF-900
133636	18:33860	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017963	MF-408
UCRL-JC–					
109884	18:34520	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018083	MF-420
109902	18:33828	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93013133	MF-902
110971	18:32618	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018084	MF-906
110987	18:33401	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018095	MF-700
111188	18:33515	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018635	MF-712
111556	18:32769	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018094	MF-930
111591	18:33240	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018086	MF-706
111666	18:33202	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019149	MF-906
111856	18:33428	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017993	MF-900
111857	18:34472	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017992	MF-900
112076	18:33488	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018102	MF-400
112167	18:34620	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018634	MF-712
112182	18:33316	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017974	MF-702; MF-706
112216	18:33996	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017981	MF-906
112224	18:33631	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018070	MF-420
112245	18:33632	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018103	MF-414
112263	18:33516	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018654	MF-712
112314	18:33727	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93017189	MF-706
112318	18:33966	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016530	MF-408
112344	18:34621	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018658	MF-712
112347	18:33203	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017972	MF-700
112377	18:34622	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018656	MF-712
112438	18:33204	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016416	MF-904
112511	18:33517	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018662	MF-712
112556	18:34707	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018082	MF-406
112573	18:34688	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017181	MF-705
112660	18:34009	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017975	MF-506
112666	18:32492	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018641	MF-940
112669	18:32493	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019145	MF-721
112670	18:32494	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018625	MF-721
112716	18:34689	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017194	MF-705
112762	18:34623	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018096	MF-423
112950	18:34435	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016538	MF-706
113033	18:34624	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018092	MF-422
113039	18:33789	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019156	MF-402; MF-405
113151	18:33205	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018659	MF-700
113165	18:34521	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016996	MF-700
113179	18:34522	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017150	MF-406
113180	18:34411	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018089	MF-705
113264	18:34523	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019157	MF-420
113265	18:34524	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019158	MF-400
113334	18:33739	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016997	MF-700
113498	18:34436	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014420	MF-712
113529	18:32351	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016993	MF-704
113555	18:32495	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018640	MF-906
113561	18:34690	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017994	MF-405
113579	18:33449	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017190	MF-706
113605	18:34437	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018636	MF-712
113625	18:34010	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017102	MF-705
113626	18:34691	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017104	MF-700
113638	18:33518	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017195	MF-705
113651	18:33450	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018069	MF-900
113664	18:33041	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017991	MF-400
113668	18:34412	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018629	MF-700

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
113721	18:33686	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017192	MF-706
113731	18:33829	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017973	MF-902
113742	18:33429	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019151	MF-900
113747	18:34011	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018652	MF-700
113750	18:33402	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018626	MF-700
113768	18:34445	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018632	MF-700
113814	18:33451	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018557	MF-712
113823	18:34692	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017977	MF-900
113854	18:33403	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016990	MF-906
113858	18:34693	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016442	MF-705
113871	18:33140	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018099	MF-702
113874	18:34694	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018106	MF-705
113875	18:34695	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016429	MF-705
113914	18:34429	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018101	MF-700
113936	18:33130	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018068	MF-700
113960	18:33687	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018638	MF-906
114013	18:33790	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016527	MF-400
114014	18:33688	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018663	MF-700
114015	18:33689	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018664	MF-700
114098	18:33791	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017118	MF-402
114211	18:32334	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017971	MF-517
114214	18:33489	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018665	MF-414
114326	18:34430	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018093	MF-701
114422	18:33452	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018660	MF-900
114531	18:34625	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017172	MF-712
114575	18:34446	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019632	MF-900
114580	18:33626	*See* SSCL-Preprint–449			
114597	18:32614	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019150	MF-700
114625	18:33633	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018090	MF-411
114922	18:32628	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018631	MF-700
114930	18:33792	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018630	MF-700
114935	18:33430	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018097	MF-900
UCRL-LR–					
108906	18:33740	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019117	MF-906
113062	18:34525	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018067	MF-700
113578	18:33741	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE93018914	MF-744
113984	18:34526	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019108	MF-426
UCRL-MA–					
108598	18:33206	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019920	MF-905
113603	18:34696	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018066	MF-705
USGS-WRI–					
93-4054	18:33804	*See* DOE/ID–22107			
UVA–					
527406/MANE93/102	18:32798	*See* DOE/ER/12931–2			
WAPD-T–					
2989	18:33207	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018049	MF-502; MF-504
3010	18:33208	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018050	MF-504; MF-523
WHC-EP–					
0182-60	18:32496	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018060	MF-902
0182-61	18:32497	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018064	MF-940
0474-08	18:32578	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040340	MF-940
0522	18:32498	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018736	MF-940
0567-1	18:32499	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019494	MF-940
0595	18:33830	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017594	MF-902
0599	18:32500	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040338	MF-940
0626	18:32501	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019492	MF-940
0629	18:32502	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018061	MF-940
0640	18:32503	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018062	MF-940
0644	18:32504	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018501	MF-902
0651	18:32505	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019122	MF-902
0660	18:32506	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019130	MF-940
0661	18:32507	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018059	MF-906
0662	18:32508	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040339	MF-900
0667	18:33209	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019985	MF-900; MF-904
WHC-MR–					
0406	18:32509	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018731	MF-940; MF-902
0413	18:32510	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018065	MF-902

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
WHC-MR–					
0416	18:32511	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017799	MF-940
0423	18:33404	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019974	MF-940
WHC-SA–					
1753	18:32512	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019124	MF-940
1807	18:32513	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018734	MF-940
1815	18:32812	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019131	MF-523
1816	18:32900	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019129	MF-940
1826	18:33959	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019120	MF-607
WHC-SD-EN-AP–					
129-Rev.1	18:33831	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018741	MF-630
139	18:32514	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019266	MF-630
142	18:32515	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019353	MF-630
WHC-SD-EN-TI–					
110	18:33832	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018745	MF-940
120	18:32579	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018747	MF-630
136	18:32304	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018744	MF-630
171	18:33833	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018746	MF-630
172	18:32580	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018743	MF-630
174	18:32516	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040394	MF-902
WHC-SD-EN-TP–					
030	18:33697	OSTI; NTIS; GPO Dep.	E 1.99:	DE93018518	MF-940
WINCO–					
1101	18:32581	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014822	MF-507
1124	18:32582	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014827	MF-510
11902	18:32535	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014881	MF-510
11913	18:32536	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93015574	MF-507
11918	18:32517	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93015662	MF-510
11921	18:32583	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93014882	MF-510
11926	18:32518	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93015567	MF-902
WJSA–					
92-01-Vol.1	18:34586	*See* DOE/ER/54100–1-Vol.1			
92-01-Vol.2	18:34587	*See* DOE/ER/54100–1-Vol.2			
WSRC-MS–					
92-267	18:32519	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93017279	MF-701
92-460	18:32901	OSTI; NTIS; GPO Dep.	E 1.99:	DE93015830	MF-706
93-025	18:32946	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018769	MF-706
93-073	18:32615	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93016741	MF-705
93-091	18:34626	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018767	MF-704
93-178	18:32947	OSTI; NTIS; GPO Dep.	E 1.99:	DE93013572	MF-706
93-263	18:32520	OSTI; NTIS; GPO Dep.	E 1.99:	DE93017290	MF-700
93-326	18:33793	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018193	MF-702
93-361	18:33834	OSTI; NTIS; GPO Dep.	E 1.99:	DE93016269	MF-703
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89-675	18:32521	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018773	MF-701; MF-721
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92-656	18:32949	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018977	MF-705
93-0723	18:33835	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018774	MF-702
93-498	18:32950	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019274	MF-705
93-692-Rev.1	18:32522	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019275	MF-721
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92-308-Rev.1	18:32523	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018200	MF-701; MF-721
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93-251	18:32526	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93018775	MF-707; MF-721
93-273	18:33836	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019839	MF-703
93-274	18:32537	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019838	MF-702
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93-277	18:33839	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019613	MF-702
93-278	18:33840	OSTI; NTIS; GPO Dep.	E 1.99:	DE93019829	MF-702
93-280	18:33841	OSTI; NTIS; GPO Dep.	E 1.99:	DE93040069	MF-702
93-293	18:32527	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93019837	MF-704
93-299	18:32629	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE93040072	MF-706
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